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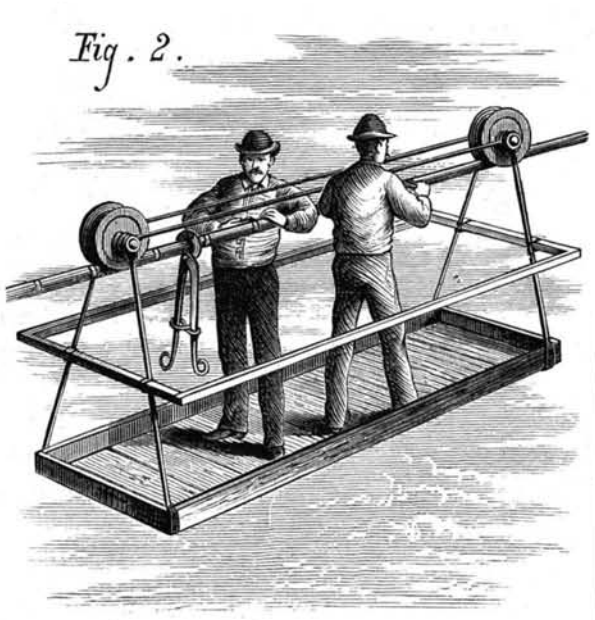
CABLE MAKING OF THE EAST RIVER BRIDGE.

The stage of work through which the great East River Suspension Bridge is now passing may be considered that which includes the first permanent steps toward the formation of the superstructure or bridge proper. Hitherto piers and anchorages have been erected, the river spanned by a slender foot bridge, and the attendant temporary guys and braces, but until the last few days it has been impossible to say that any integral portion of the vast mass of suspended wire has reached a finished state. Now, however, two huge strands, respectively belonging to two huger cables, are permanently fixed in their great shoes pinned between the colossal eye bars of the anchorages, and fixed in the graceful curve with which they sweep over the river, their centers marking the lowest point of the majestic structure which they are to aid in supporting. In order to clear up any doubt in the reader's mind as to what the main cables and their office are —for to these the strands now finished belong—it may be well to explain that the bridge is to be held up by four immense wire ropes, or more strictly bundles of wire, for, contrary to general supposition, there is no twist in them. These cables pass from anchorage to anchorage, rising over the tops of the piers, two crossing the latter near the middle and one at each end. Their course can easily be followed on the engraving of the bridge as it will appear when finished in our next issue. It will be seen that the roadway which extends straight across the river from floor to floor of the great arches to the piers, and then from piers to anchorages, is suspended by smaller vertical cables of constantly varying length.

Each one of these mighty principal supporting ropes is composed of nineteen strands, and each strand is made of 260 steel wires. The size of wire now used is number 7. Number 8 was first employed, but the larger size was preferred. When these wires are laid side by side, they make a bundle 3



inches in thickness, and the weight and tension of the bundle extending as it does from anchorage to anchorage, appears in the shape of a pull of 40 tons at each end. So that each entire cable will exert a strain of just nineteen times that amount.

In this and the following article we propose to explain how these main cables are made, for although we shall describe simply the preliminary operation of strand making and securing, it will readily be seen that further operations involve but a series of repetitions.

It may be remembered that after our examination into the way the steel wire was made (the results of which we embodied in an article some months ago) we left the wire in large coils some five feet in diameter. Following these coils now to the Brooklyn anchorage—where is the spinneret whence the great cobweb is emerging thread by thread—we shall find them dipped in oil, dried in the air, dipped again and again until a moderately thick coat of hardened grease has changed their bright zinc lustre into a dirty yellow. Then they are carried up on the top of the anchorage, reeled off on large wooden drums, and from these last they are paid off as required. We have already explained how the first wires were got across the river. One of the first conveniences afterwards put in place was the carrier rope. This is simply an endless wire cable which starts from the Brooklyn anchorage, passes over the two piers in turn, then to the New York anchorage, on top of which are two horizontal pulleys, around which it leads, then back to Brooklyn, and finally after passing around an immense horizontal engine-driven drum the ends are joined. One part of this carrier rope carries wire for one inner main cable, the other part for the corresponding outer main cable. On each part is attached a traveler wheel, which is represented in Fig. 3. This is a light

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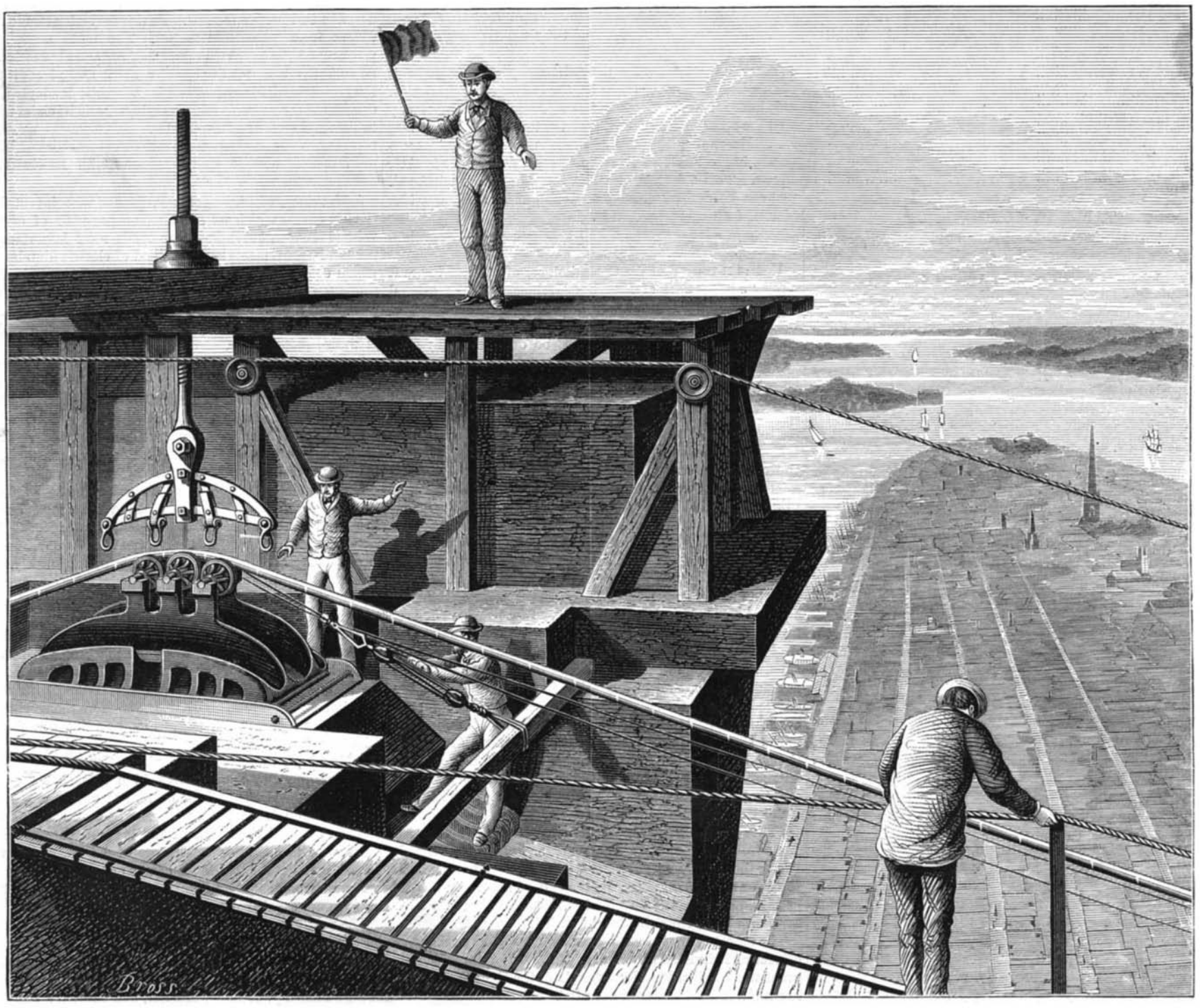

CABLE MAKING OF THE EAST RIVER BRIDGE.

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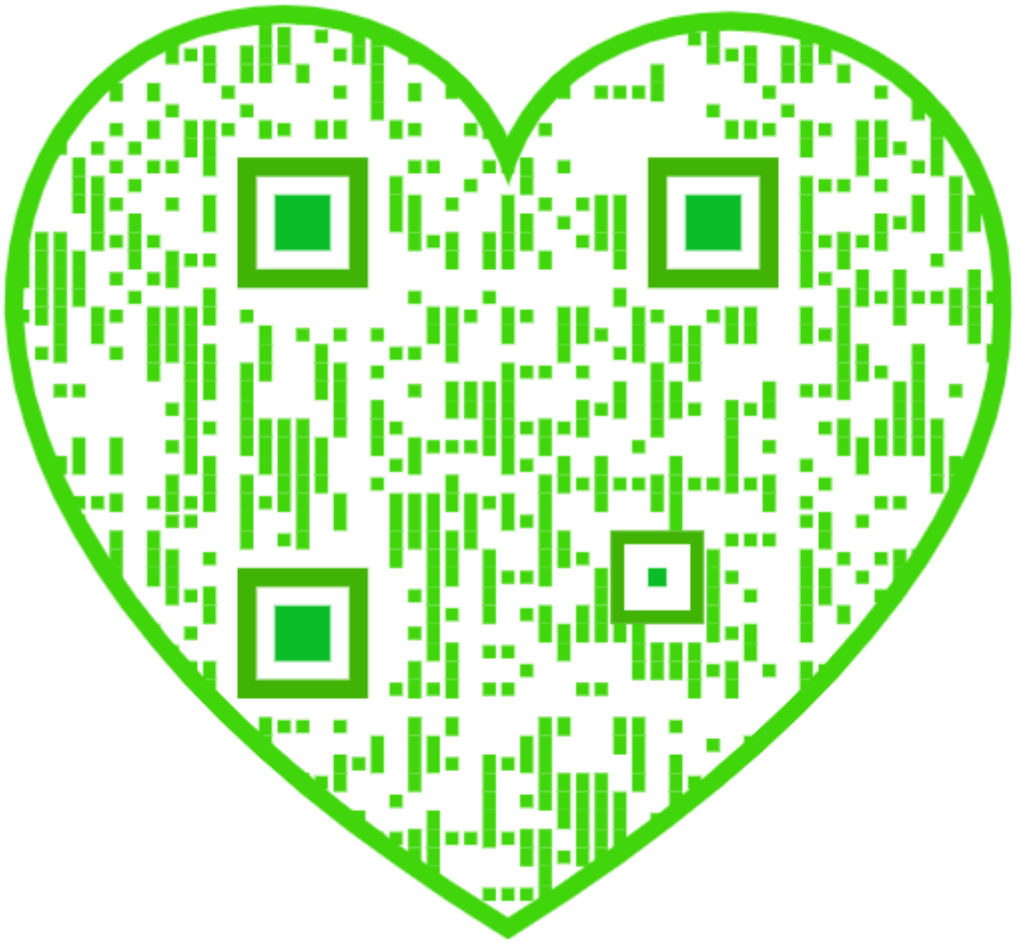

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NEW YORK, SATURDAY, AUGUST 4, 1877.

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TORPEDO DEFENCE—INVENTION WANTED.

An invention that will protect ships of war from attacks of torpedoes is wanted; and this want ought to stimulate the inventive skill of mechanics and scientific men. Torpedoes in some form have played an important part in the wars of latter years, but these torpedoes were not the infernal machines that are now being employed. In former days they were receptacles filled with explosive material, and were either anchored in the pathway of vessels or floated to the object that was desired to be destroyed. They were fired by concussion, clockwork, or time fuse. The location of such torpedoes could most generally be discovered, if proper attention was directed toward their places of concealment.

Torpedoes of that class were playthings compared with the inventions of Lay, Ericsson, Whitehead, and Thorneycroft. The approach of these messengers is submerged and their pathway cannot be discovered by the assailed party. From them the greatest danger is to be apprehended.

Let us take, for example, the Lay torpedo, notices of which performance have appeared in our columns, and there seems to be but little protection from its attack. It is launched silently, and with accuracy it speeds toward its intended victim. The operator being on shore, or at a distance, is able to navigate it through crooked and intricate channels, and direct it at his will to unerringly strike its formidable antagonist and sends him a wreck beneath the waves. But if this antagonist be anchored, precautions of safety may be employed. A net-work of iron may be supported on booms, or pendent below the vessel's keel, through which the torpedo cannot burst. A cordon of ropes may surround the vessel, supported on boats in which are watchful crews to give an alarm. Other devices may be employed; but they more or less interfere with the sailing qualities of the vessel, and would seriously retard its management should an antagonist present himself, and an engagement ensue.

Protruding spars may keep off a torpedo boat, similar to the Thorneycroft launch, and the electric light would determine its position. But let this vessel be attacked by the Lay torpedo, or others of like character, and such defense is futile. The net-work of wire will keep it at a distance, but the objections to its use, except at anchorage, are as given. At a recent attack of four torpedoes upon a Turkish vessel in the Danube, the commander saved his vessel by coolness and quick manœvering. But the type of some war vessels is such, especially those heavily armored, that they cannot be thus handled, and would therefore at times present opportunities for the approach of their fleet-moving antagonists.

What the protection for the swift and unseen movements of submerged torpedoes may be, the future can only decide. It is left for inventors to work out. As a hint, we say study well the action and approach of the torpedo, submerged as it is. Remember they are swift and unseen in their movements, impregnable to attack, and most destructive in their effects. That a defence can be wrought out that will be all that can be desired we have no doubt, and he may consider himself fortunate who does it.

NOTES OF PATENT OFFICE DECISIONS.

Upon the refusal of the Commissioner of Patents to grant a reissue in the case of Mayall & Williams on the ground that an interfering application had been filed subsequent to the date of their patent, and that the grant of this reissue depended on a question of priority, to be determined by him, as between the interfering application for patent and the patent of Mayall, the Supreme Court of the District of Columbia declared this decision of the Commissioner void and of no effect, and decided that the appellants were entitled to a reissue and that the same be reissued to them.

Upon the rendering of this decree the rules of the Patent Office have been amended to accord with this decision. All interferences now pending between reissue applications of prior patents and later patents, or with applications for reissues of later patents, or with subsequent original applications, will be dissolved; but on motion, the record in the interference proceeding may be amended by the substitution of the reissued patent in place of the original patent. An application has been made by C. W. Siemens for a reissue of a patent on furnaces granted in 1869. Some claims were set up for devices contained in certain expired foreign patents, the inventions of the applicant. The Commissioner has decided that the applicant had no right to a reissue, and could not claim matter shown in a prior foreign patent that has expired. One of the reasons given is that the subject matter could not be protected in the courts, and on that account the patent should be refused, that in such cases no distinction should be made between the original application and reissues. No color should be given to an individual claim, by granting a patent purporting to secure a right, when the Office has no such right to confer.

Under the act of 1836, patents were limited to fourteen years from the date of foreign patents previously obtained. Under the act of 1861, all patents granted were to remain in force for seventeen years from the date of issue. In the act of 1870, patents granted to foreign inventors were limited to seventeen years from the date of such foreign patent.

The object of the reissue section is to provide a means of correcting individual patents; and if the period for which the grant was originally made has expired, the right to claim the invention in a reissue does not exist.

That portion of the invention patented in England in 1861 has not yet expired by limitation of seventeen years from its date, and can be retained.

An appeal from the decision of the Examiners, and confirmed by the Commissioner, has been made in the case of W. W. Bierce, for improvement in strip or ribbon tickets. The object is to use these tickets on street railways. The design was to sell these tickets in strips, with one or more tickets made to be redeemable. The decision was that this form of tickets was old, and that the system of redeeming tickets old also. The refunding of money to the possessor of certain tickets is not essentially an improved device or article, but rather a method of transacting business, and this method is not patentable, as it neither relates to a machine, manufacture, or composition of matter.

A claim had been made by James Arkell for a paper bag with a jaggedly cut mouth and also the method of making it. The claim for the article was rejected, which was acquiesced in and the claim stricken out. A few days before issuing the patent for the process, the applicant filed a claim for the article. He should have applied for a reissue, and included this claim therein. The Commissioners concurred in the views of the examiners that a notch had been used in others than these with a jaggedly cut mouth and for precisely the same purpose, to facilitate opening, and it merely resulted in the double use of an old device.

TRADE MARKS.

The registration of a trade mark that is not identical with yet so closely resembles another as to mislead the public, is denied to Coggin, Kidder & Co., as is also the addition of an arbitrary symbol of a Maltese cross to the trade mark, which is declared not to amount to sufficient difference to warrant registration. In the judgment of the Commissioner, the leading word was calculated to mislead the public, yet when the two words were seen side by side, the difference could readily be perceived.

In the application for a trade mark by W. S. Kimball, filed in eight different arrangements of figures in connection with the trade mark, to show the modes in which it had been applied and used, the decision was that the facsimile of the trade mark was sufficient, and that no protection is afforded to the use of scrolls, or figures that are not an essential part of the mark. To recognize them would tend to mislead the public as to the scope and nature of the registration.

The question of priority in the use of a trade mark in the case of Swift *vs.* Peters has been decided to have nothing to do with the question as to who first conceived the idea, or to describe and propose its use. In this respect a trade mark differs from patentable matter. The trade mark is the property of the party who puts it into actual practice. If an employee suggests the use of a mark and places it upon the packages of his employers, by whom it is adopted, it is considered the property of the employer, and its claim denied to the employee who suggested it.

RECENT GREAT IMPROVEMENTS IN ELECTRIC ILLUMINATION.

Jablochkoff, of St. Petersburg, Russia, who invented the electric candle which we described on page 339 of our last volume (June 2, 1877), has since made most important improvements in the method of electric illumination, which consist, first, in sub-dividing a current, producing a single too intense light in several smaller ones, say fifty, each producing a light of an intensity measured by one to fifteen gas burners; and, secondly, in abolishing the use of carbons in these smaller lights.

It may be well to observe here that the Russians are very deserving in the pursuit of science, especially the electrical branch: it was Jacobi, in St. Petersburgh, who, forty years ago, made the first electrotypes and navigated the Neva with a boat propelled by an electro-magnetic motor; and now it is Jablochkoff who makes electric illumination such a success that it is bound to supersede other methods.

Since his first experiments with electric candles he found, that, if a continuous light is obtained by one single current in several of his candles, it is chiefly due to the fact that the isolating substance between the carbons is, at its upper end between the luminous points, in a highly heated and nearly fused condition. In this state it offers a much better conductor to the current than it finds between the carbon points attached to regulators where the current has to pass through the resistent atmosphere. Experience showed that with a certain tension of the current excited by the machine, the limit to which this current can be subdivided through the melted conductors is sufficient to generate several luminous points of relatively high luminosity. But no more than eight electric candles could, in this way, be fed by a single machine of middling size.

Jablochkoff, therefore, tried the action of the electric spark, produced by a current of high intensity, upon fireproof bodies. He passed the current of a dynamo-electric machine through the inner wire of a Rühmkorff induction coil, and caused the spark of the induced current in the outer wire to act upon small bars of kaolin, which were placed between the terminals of the outer coil. This current was strong enough to glow and melt small kaolin bars, but was not capable of making them highly luminous.

The next experiment was to pass the current through better conductors which would, as it were, attract the current, and which he fixed to the edge of the kaolin bar, which, being a conductor of great resistance, by passing a current of high intensity, became white hot, and emitted a fine light. A small consumption of kaolin was observed, which, during

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the experiment, amounted to one millimeter (one twenty-fifth of an inch). The light, which in this way can be produced by the secondary wire of the induction coil, is seen in the form of a beautiful luminous band, which can be made to attain a much greaterlength than the induction spark obtained from the Rühmkorff coil alone. But this luminous band, in place of disappearing with the spark, is a permanent source of light, which gives as quiet and steady a light as any other known source. In regard to the intensity of the light, this depends on the amount of wire and the size of the induction coil.

As it is possible to insert a great number of induction coils in the current of a Gramme machine, and as further the induced current developed by every coil can be subdivided into different sections, it is possible to attain a perfect subdivision of the electric light. Nothing is easier than to obtain in this way say 50 luminous points, of any desired intensity.

In the experiments referred to, induction coils of various sizes were used. The intensity of the light was various in proportion to the size of the coils. The intensity of the various luminous points was graduated in such a way that the weakest gave a light of 1 to 2 Argand burners, while the strongest was made equal to 15 burners. When machines producing alternate currents are used to excite the Rühmkorff coils, the contact breakers and condensers of these coils become of course unnecessary. In this case the whole system of subdivision of the current can be reduced to one principal conducting wire, of which the function is performed by the primary wire of a Rühmkorff coil, around which then as many secondary coils are wound as secondary currents are required. Every luminous point is then perfectly independent of every other luminous point, and can be ignited or extinguished without interfering with the others. The division of a current in a building to be illuminated with electricity becomes then similar to gas illumination. In a manufactory the illumination may be so arranged that the large rooms are illuminated by electric candles, the office, the entrances, the halls, etc., by the electric bands. The apparatus for small halls is of a surprising simplicity, and consists of a small porcelain rod, which is kept in incandescent condition with very little wear.

To recapitulate the results obtained by Jablochkoff we may say that they consist: 1. In a perfect subdivision of the electric light. 2. Perfect steadiness of the thus subdivided light. 3. The possibility to give any luminous point every desired degree of intensity. 4. Dispensing entirely with the carbons in lamps of smaller and medium luminosity.

NEW INVESTIGATIONS ON COPPER ALLOYS.

Professor R. H. Thurston has recently conducted, at the Mechanical Laboratory of the Stevens Institute of Technology, an extended series of investigations into the properties of the copper-tin and copper-zinc alloys. From the records of the researches we have, through the courtesy of Professor Thurston, gathered the more important results obtained, and they are herewith presented.

COPPER-ZINC ALLOYS.

The experiments upon copper-zinc were begun by casting one series of 21 bars, each 28 inches in length and 1 inch square in section, and then a second series of 20 bars of similar size. In the first series the proportions of zinc and copper differed regularly for each bar, to the extent of 5 per cent, bar 1 containing 5 per cent of zinc, bar 2, 10 per cent, and so on up to 100 per cent of pure zinc. In the second series the first bar contained 2½ per cent, and the last 97½ per cent of zinc, the relative differences being the same.

By examination of the color of these various alloys it appears that they may be divided into three clearly marked classes, viz: the yellow alloys, which excludes all those containing less than 55 per cent of zinc; the silver white and brilliant alloys containing between 60 and 70 per cent of zinc, and the bluish-gray alloys, containing more than 75 per cent of zinc. On applying tests for transverse strength, it appears that the first class above noted may be divided into two divisions, one showing considerably more strength than the other; in the first are included the bars containing from 17·99 to 33·50 zinc (and probably all the alloys from pure copper to the latter limit). These show a modulus of rupture (by which is meant a value proportional to the transverse strength of a bar, and which is theoretically equivalent to 1½ times the load which would break a bar of 1 unit in length, breadth and depth, supported at both ends and loaded in the middle) from 21,000 to 28,000, and are characterized by great ductility and an earthy fracture. The second division includes alloys from 38·65 zinc to 52·28 zinc inclusive, which show greater strength than the preceding. The point of maximum strength is determined to be between 38·65 zinc and 44·94 zinc. The second class of alloys show great weakness and lack of ductility. The minimum strength was found in alloy of 65 per cent zinc, the modulus of rupture being but $\frac{1}{10}$ of the maximum. Alloys of the third class showed much greater strength than those of the second, but not equal to that of those of the first.

In tensile strength alloys containing up to 50 per cent zinc average 30,000 lbs. to the square inch and are classed as useful metals. 60, 65, and 70 per cent zinc alloys are very weak, the highest average being that of the 60 per cent alloy, which is 3727 lbs. to the square inch. The remainder of the 21, or third class, average from 18,065 to 5,400 lbs. per square inch; pure zinc being the weakest. The maximum strength is possessed by an alloy containing somewhat less than 44 per cent of zinc, and the minimum tenacity is 1,774 lbs. per square inch in an alloy of 70 per cent zinc. In torsional tests the average results agreed with the foregoing. In compression the 55 per cent alloy showed a maximum of 121,000 lbs. to the square inch, pure zinc yielding at 22,000 lbs. Tests conducted on the second series of alloys closely confirm the results already stated and need not be detailed.

It is well known that, no matter how accurately alloys may be compounded, chemical analysis of the metal after casting often reveals a notably different composition. In analyzing the copper-zinc alloys above noted it was found that the only general differences, between the components of the original mixtures and those determined by analysis, was that in almost every case a smaller percentage of zinc appeared and a larger percentage of copper. The real decrease of zinc is believed to be due to volatilization of the metal in melting and casting. The average loss was from 1 to 2 per cent in a bar. In several bars a considerable amount of liquation took place, and in general the upper end of the bar contained the highest percentage of copper.

The variation of specific gravity with change of composition follows a very definite law, decreasing very regularly with the increase in percentage of zinc. None of the zinc-copper alloys have a greater density than that of pure zinc, tne only apparent exceptions being caused by the presence of pores and other flaws.

COPPER-TIN ALLOYS.

In the experiments on the copper-tin alloys, bars of the same size as already noted were first cast. Two series of alloys were prepared, the first numbering 30 compositions, beginning with pure copper and then varying in percentages of tin from 1·9 up to 99·44 and ending in pure tin. The second series consisted of 20 bars ranging from 97½ per cent copper and 2½ per cent tin to 97½ per cent tin and 2½ per cent copper, with a regular difference of 5 per cent.

Alloys containing respectively 1·9, 3·73, 7·20, 10, 13·43, 20, and 23·68 per cent tin were found to have considerable strength; and all the rest of series 1 are stated to be practically useless where strength is a requirement. The dividing line between the strong and brittle alloys is precisely that at which the color changes from golden yellow to silver white, viz: at a composition containing between 24 and 30 per cent of tin. Alloys containing more than 24 per cent of tin are comparatively valueless. Tests by tension give results according with the foregoing. Generally it appears that the tensile and compressive strengths of the alloys are in no way related to each other; that the torsional strength is closely proportional to the tensile strength, and that the transverse strength may depend in some degree upon the compressive strength; but it is much more nearly related to the tensile strength as is shown by the general correspondence of the curve of the transverse with that of the tensile strength. The maximum crushing strength was given by the 30 per cent tin alloy and the minimum by pure tin.

The results of the tests for transverse strength on the second series do not seem to corroborate the theory given by some writers that peculiar properties are possessed by the alloys which are compounded of simple multiples of their atomic weights or chemical equivalents, and that these properties are lost as the composition varies more or less from this definite constitution. It does appear that a certain percentage composition gives a maximum strength, and another certain percentage a minimum; but neither of these compositions are represented by simple multiples of the atomic weights. Besides, there appears to be a perfectly regular law of decrease from the maximum to the minimum strength, which does not seem to have any relation to the atomic proportions but only to the percentage composition. On analyzing the copper-tin alloys there appears to be a greater loss of tin than of copper in the bars which contain the greater percentage of copper, and a greater loss of copper, than of tin in the bars which contain the largest percentage of tin; and that the bars which contain about equal amounts of the two metals show a great tendency to liquation. In the alloys containing less than 35 per cent of tin by original mixture there is a greater loss of tin than of copper, with but three exceptions. In the alloys containing more than 70 per cent of tin, there is a greater loss of copper than of tin, with only one exception. In all of the alloys of these two classes the extreme variation of a single mixture is 3·6 per cent, and generally it is less than 1 per cent. It further appears that the actual specific gravities of all the alloys containing less than 25 per cent of tin does not greatly vary from 8·95.

BALANCING EMERY WHEELS.

The proper balancing of emery wheels is of great importance, because the great speed at which they revolve causes the least defect in the balancing to vibrate the wheel when in motion. This vibration causes undue wear to the wheel as well as tending to throw the wheel out of true. Of late cast iron spindles are being introduced for emery wheels above 10 inches in diameter, and they require very careful manufacture to properly balance them. In the first place the existence of air holes is a great disturbing element, and in the next place the position in the mould, in which the iron is cast, is found to be of practical importance, because the iron at the bottom is found to be more dense and heavier than that at the top. To remedy these defects, the castings were given very large gates or runners, the cope of the mould being made extra deep for that purpose. This, however, proved successful for the prevention of air holes, but not altogether so for equalizing the density, the difference between the top and bottom of the metal being very plainly perceptible. This led to the adoption of the plan of casting vertically as well as casting them in longer pieces, using only the lower end for the spindle. The result is, not only is the formation of air holes prevented, but the metal is at any part of its length of practically equal density diametrically. This, however, is of minor importance. The next consideration is to center the spindle to run as true as possible in the lathe, for the metal is always more dense at and towards the outside of the casting; and if more is turned off one side than the other the balance will be, to a like degree, affected. After the spindle is turned, its balance should be tested by placing it upon two knife-edged parallel pieces set horizontally true, and setting it in motion. Note the side that is downwards when the spindle comes to rest. If upon turning it upside down and end for end, and making several tests, the same side is always at the bottom when the spindle comes to rest, that side is the heaviest, and should be adjusted by boring a small hole, either in the end or upon the circumference.

The part of the spindle upon which the driving pulley fits should be made a neat driving fit to the pulley, so as to avoid the use of a key, which would destroy the balance. The centers of the spindle should be center drilled and countersunk, so that the spindle may keep true during the whole turning operation, the end faces being carefully turned true for the same purpose. The pulley should be cast with its diameter standing vertical, the hole should be bored out true and smooth, the wheel should be turned down to very nearly the finished size upon a temporary mandrel, and then placed in position upon the spindle and finished in the lathe while upon the spindle. Then the wheel and spindle together should be tried upon the knife-edged parallel strips in the same manner as the spindle was tested.

The washer should be cast flat and carefully turned true, the inside face being recessed to within about one quarter of inch of the circumference, which is done to ensure that it shall grip the wheel at and near its edge, thus holding it true as well supporting it as far out from the center as possible. The nut should be made very true, the thickness from the bore to each flat side being made quite equal. The best form of nut is a cylindrical one with two flat sides, which is the easiest form to make and ensure truth. The washer and nut should be placed upon the spindle, and the balancing of the whole again tested upon the parallel strips. The emery wheel may then be fastened upon the spindle, the bore being made a neat sliding fit, and then the strips should again be brought into requisition to test the balance while the whole are together. The wheel is very liable to require balancing, because it is very difficult to make a wheel of equal density throughout. If the wheel is out of balance it must be corrected in the wheel itself, and not by drilling holes in the spindle or pulley, because in that case the wheel, though balanced when new, will lose its balance as it wears smaller. It is necessary, therefore, to provide a center piece and to throw the wheel out of true in the lathe, taking care that the densest side is the prominent one; then by taking a cut down the radial face of the wheel, leaving it just true, the balance may be corrected. The center, however, should be thrown out but very little, and the balance tested. The process should be repeated till an exact adjustment is attained. By adjusting the balance in this manner, the spindle will, when once made, never require altering; and all that is necessary is to balance, in the manner described, each new wheel when it is put on, and the result will be sufficiently perfect for all practical use.

THE GREAT RAILROAD STRIKES.

The strike on the Baltimore and Ohio Railroad which commenced about the 16th inst. has assumed such character and proportions that the State authorities of Virginia were unable to cope with it, and the interference of United States authority has been called to quell the disturbance. If the organization of the train men is sufficiently perfect and extensive it will extend to many other roads. A strike and much trouble will result. It has already commenced on the Pennsylvania Central Road, and apprehensions of similar trouble are feared in Michigan. The strike on the Chesapeake and Ohio canal still continues. At Cincinnati developments indicate a strike on the several roads centering at that place. On the Central Ohio division, all freight trains have been detained. The employees of the Great Western Railroad of Canada are protesting against a reduction of wages, but have made no other move.

The employees of the western division of the Erie road have struck, demanding the pay received before the reduction and a free lease of property to squatters on the roadlands, and free passes to firemen, brakemen, switchmen, and trackmen, which the company refuse. Prospects are that the Ohio and Mississippi road may be included among the strike. The trouble on the Pittsburgh and Fort Wayne road is assuming a serious aspect. Meetings are being held by the employees of the Union Pacific, and an outbreak is feared.

The central council of the Labor League of the United States held a meeting at Washington and have recommended moderation and to avoid strikes, and resolved that moral agitation is the strength and power by which labor can acquire tangible reformation and that mob violence and riot lead only to anarchy and final destruction of human liberty.

SHELLAC dissolved in alcohol will be found to be a good cement for broken furniture.

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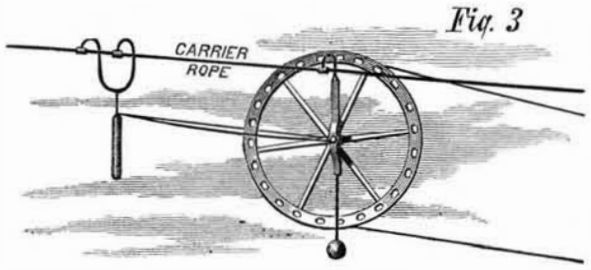
[*Continued from first page.*]

wheel of wood and tin, turning in bearings suspended from the rope; braces are arranged in connection with it to prevent oscillation. Over this wheel the bight of the wire to be laid is passed. One end of the wire is fastened, the other goes to the reel. Now the drum of the carrier rope turns, and the wheel attached to the latter starts on its journey. The wire gradually unwinds from the reel, the wheel goes on over the piers and finally comes to rest on the New York anchorage. There the bight of wire is slipped out of its groove and put around a massive iron shoe—about which we shall have considerable to say in our next article—and then the motion of the carrier rope is reversed and the empty wheel returns. At the same time another wheel carrying another bight of wire for the second cable starts across, and thus the work continues, a filled wheel constantly going out and an empty returning—two strands of two different cables being thus simultaneously made.

Fig. 3



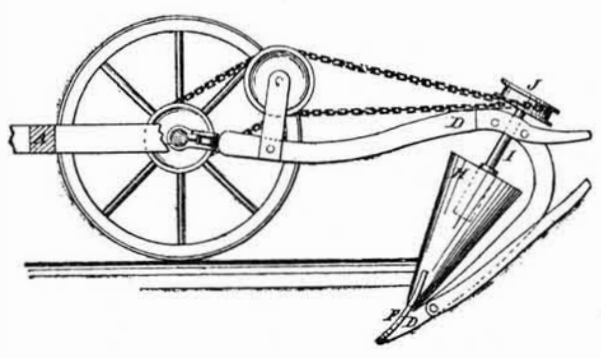
After each wire is laid it must be brought to the same curvature as the wire preceding it. To do this, after the carrier has passed the wire from the anchorage over the saddle at the top of the pier, it is stopped and a tackle attached as shown in the engraving. To ascertain the requisite amount of distance to be raised or lowered from the top of the pier to the anchorage is easily done, and we will suppose the tackle is released and the traveler has passed on its way to the opposite pier, where it is again halted and the tackle attached. Flagmen are stationed on the cradles, of which there are three between the piers, who report by means of pre-arranged moves of their flags to the flagman on the top of the pier the amount of deflection there may be in the wire, and it is according raised or lowered, as may be demanded.

When the requisite number of wires are laid to form a strand, an apparatus called a "buggy," shown in Fig. 2, is attached to this strand and made to travel upon it. The workmen in the buggy gather the wires into a bundle and retain them with a pair of peculiarily shaped tongs and temporarly bind the strand with wire at intervals of about twenty-eight inches. When nineteen strands of the cable are finished and placed side by side, the wrappings about the strands will be removed, and the entire 5,700 wires will be bound together by encircling wires, so as to form a solid cable in which there will be no strands. After each strand is bound, the yoke, seen suspended above the massive saddle upon which the strand rests, is lowered; the clevises, of which there are four, are removed and, clasping the strand, are bolted in their former places. The capstan nut, seen at the top of the framework over the yoke, is rotated, and as it revolves on the screw to which the yoke is suspended, it raises both yoke and strand until the latter is clear of the pulleys on the saddle. The pulleys are then removed and the strand is lowered away into its bed in the saddle underneath the pulleys. The clevises on the yoke are then uncoupled, the yoke raised out of the way, the pulleys put in place, and another strand is laid similar to the previous one.

The saddles, to which reference has been made, are four massive castings resting on the top of each pier, and each one holding in its embrace one of the cables. The pulleys over which the strand passes are used for convenience in laying the strand and are removed entirely when the cable is complete and placed in its saddle. To allow for the difference in unequal contraction and expansion of the cable from anchorage and pier, and between the piers, the saddle rests upon a series of iron rolls, which allow of a change of its place, as the force of contraction or expansion is brought to bear upon it.

A ROTARY MOULD BOARD PLOW.

Mr. Charles V. Dyer, of Hallsville, Texas, has patented



through the Scientific American Patent Agency, May 22, 1877, the novel plow illustrated herewith. The rear parts of the beams, D, are curved forward to serve as standards for the plows, F. From notches in the top of the plow plates extend pivots which enter orifices in the ends of the cones, H. The latter have spindles, I, which pass through the beams, D, and are surmounted by pulleys, J, to which motion is communicated by an endless chain actuated by the wheels. As the machine is drawn forward, the cones, H, are revolved so as to turn the soil as it rises upon the plows to one side, and at the same time break it up and pulverize it.

American Institute Exhibition.

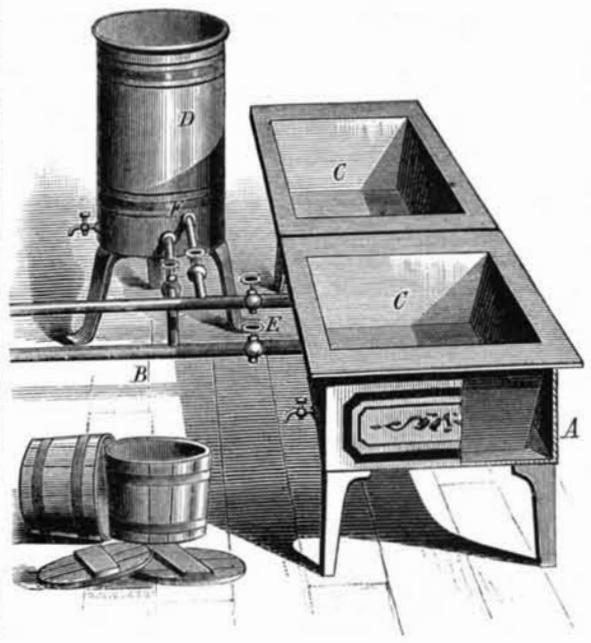
For forty-five years the American Institute of New York has opened its doors and invited American inventors and manufacturers to exhibit their productions; and again this year it renews its invitation to all. To such as wish to reach the capitalist and consumer, they must admit that New York is the place. For details apply to the General Superintendent, by mail or otherwise.

APPARATUS FOR PREPARING BUTTER FOR PACKING.

The usual way of softening butter for packing is to put it in a room that is heated by a fire to a temperature of from 80° to 100°, which takes from three to five hours to make the butter soft enough for work. Even then the butter is not uniformly softened, as some of it remains hard, while some is melted to oil, which is injurious to the quality of the butter. The invention which is illustrated is intended to obviate this defective feature. It consists of pans for holding the butter heated by a water bath, and connected with a regulating water tank, for taking up the excess of heat and hot water.

In the drawing, A represents a tank with entrance and exit pipes, B, for the steam or hot water, and valves, E, for admitting and shutting off the heat. The tank forms the water bath for the pans, C, into which the butter is placed for being softened. The tank is provided with a faucet for drawing off the collecting water, and the pipes, B, are connected with a water tank, D, having a similar discharge faucet. The water tank connecting pipe sections, F, has also valves which may be opened or closed, as required, the water in the tank serving to take up the excess of heat and hot water when the main valves, E, are shut off.

In operation the pans are to be heated to about 70° and the butter is placed therein, the workmen cutting up the rolls with ladles to expose the butter uniformly to the heat.

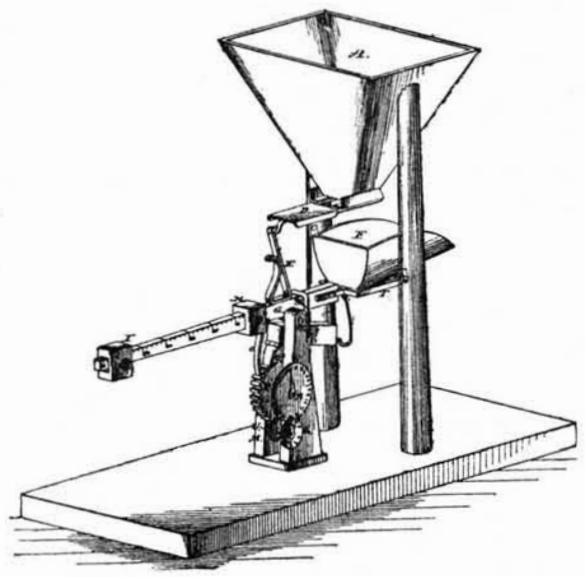


In from twenty to thirty minutes the butter is soft enough to be worked easily by hand with the ladle, the heat of the water bath producing thus about the same effect as the change of temperature from a cold to a warm day. The heat, however, is not sufficient to melt the butter so as to injure the same. Should the bath get too hot, the current of steam or hot water is shut off and conducted into the regulating tank.

Patented through the Scientific American Patent Agency, January 29, 1877, by Warren B. Bemis, of Cincinnati, Ohio.

IMPROVED GRAIN SCALE.

The annexed engraving represents a new machine for weighing and registering the weight of grain and other articles. A is the hopper or conducting pipe, from which the grain, etc., pass through an aperture in the bottom into the receiving vessel, F, to be weighed. Two rods, B, are fastened to the bottom of the hopper, one on each side of the aperture, for the purpose of connecting the slide, D, with the hopper, and on which the slide moves. C C are two pillars supporting the hopper. D is the slide which closes the aperture in the bottom of the hopper when the receiving vessel discharges its grain, and then returns to its former position, opening said aperture. E is an arm connected firmly to the upper side of the scale beam, G, and over the pivot, and attached to the slide, D, above, so as to govern the movements of the slide in opening and closing the aperture in the hopper. F is the vessel or scoop, resting, by means of the arms, T, on the large end of the scale beam, extending back under the hopper, from which it is filled, and when the weight balances the weight on the other end of the scale beam, it dips and turns on a pivot attached to the ends of the arms, T, and discharges its load. As the other end of the scale beam ascends, the slide, D, is forced back, closing the aperture in the bottom of the hopper, so that no grain escapes while the vessel, F, discharges, after which weight, I, carries the vessel, F, back, withdraws the slide, D, and the vessel is again filled, the grain weighed, discharged, the weight registered, etc. G is the scale beam, H the movable balance, fastened with thumbscrew in the scale beam. O is a ratchet attached to the under side of the scale beam, so that as the beam returns horizontally, after the vessel, F, discharges, it turns the ratchet wheel one ratchet. P is the ratchet wheel between and supported by the pillars, and to



which the registering hand of the dial, R, is attached, and moves as the wheel moves, thus registering the quantity of grain weighed or the number of times the vessel discharges. U is a small cog wheel, arranged so that when the ratchet wheel, P, makes a revolution a small ratchet in the ratchet wheel strikes a cog and turns the wheel, which causes the hand of dial, S, to revolve from figure to figure, thus registering the number of revolutions made by the hand of dial, R, and the aggregate pounds or bushels weighed.

The device was patented February 27, 1877, by Mr. P. H. Cherry, of Parsons, Kansas.

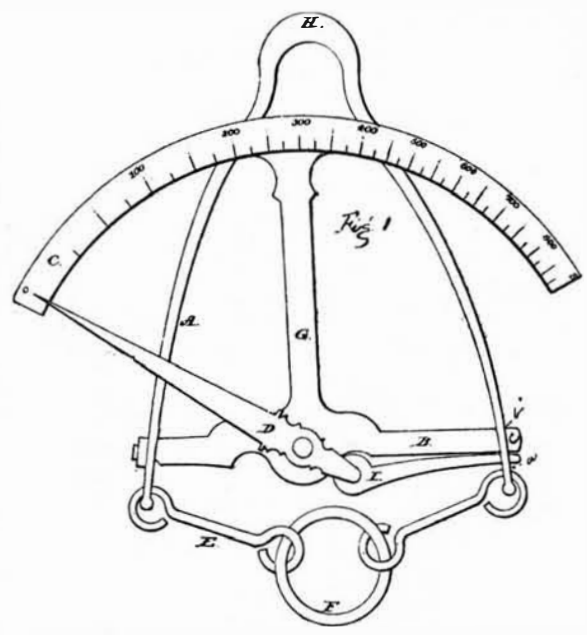
Cure for Small-pox.

Mr. Edward Hine, in the Liverpool *Mercury*, asserts that the worst case of small-pox can be cured in three days by the use of cream of tartar—an ounce dissolved in a pint of water, to be drank at intervals, when cold. He pronounces it "a certain, never-failing remedy."

A NEW DYNAMOMETER.

This device consists in the employment of a bent spring, to the lower ends of which the draft connection is attached, and at the lower ends are slots through which pass a bar having one end rigidly secured to the spring, and the other end sliding in a slot in connection with a second notched bar, passing through a slot in the bent spring, the opposite end of the notched bar being pivotally connected with a pointer, which indicates, on a graduated arc, the draught force.

The spring, A, is preferably made of cast steel of suitable length and stiffness, rounded at its upper end to form a loop, H, by means of which it may be attached to the plow clevis, or other implement, the draught power of which is to be tested. Eyes, *a*, in the opposite or front ends of the spring, receive the links, E, and ring, F, forming the draught connection. B is a bar passing through slots, *b b'*, near the outer ends of the springs, one end being rigidly secured by a bolt, or otherwise, to the spring, and the opposite end sliding in the slot, *b'*, in the outer end of the spring. I is a bar notched at *n*, passing through the slot, *b'*, the notch engaging in the



edge of the slot. To the opposite end of the bar, I, is pivoted the pointer, D. G is an arm attached to the bar, B, curved at its upper end, and carrying the indicator, C.

Patented February 6, 1877, by Mr. Jesse Blackinton, of Roscoe, Ill.

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THE AMERICAN TOAD.

The common American toad of the eastern United States is scientifically named *bufo lentiginosus*, Shaw; sub-species *Americanus*, LeConte (Professor Cope, and the Smithsonian Institution).

In Pennsylvania and New Jersey, from the latter part of March to the first week in April, according to the season, the toad quits its winter quarters. A week or so later it seeks a mate, when, most commonly at twilight, the buzz-whistling cry of the male may often be heard. The female deposits her spawn in the water, and the ova are fecundated by the male while they are being laid. They soon hatch, when myriads of larvæ, or little black toad tadpoles, may be seen in clusters in the shallow water of ponds and creeks, near the banks. The hind legs of the tadpole are the first to appear; the fore legs later, the tail disappears, and in a few weeks the young toads quit the water with the form they are to retain throughout life. In September the toad creeps into the mud of ponds and ditches, or digs a hole in a loose or sandy soil, and there hibernates.

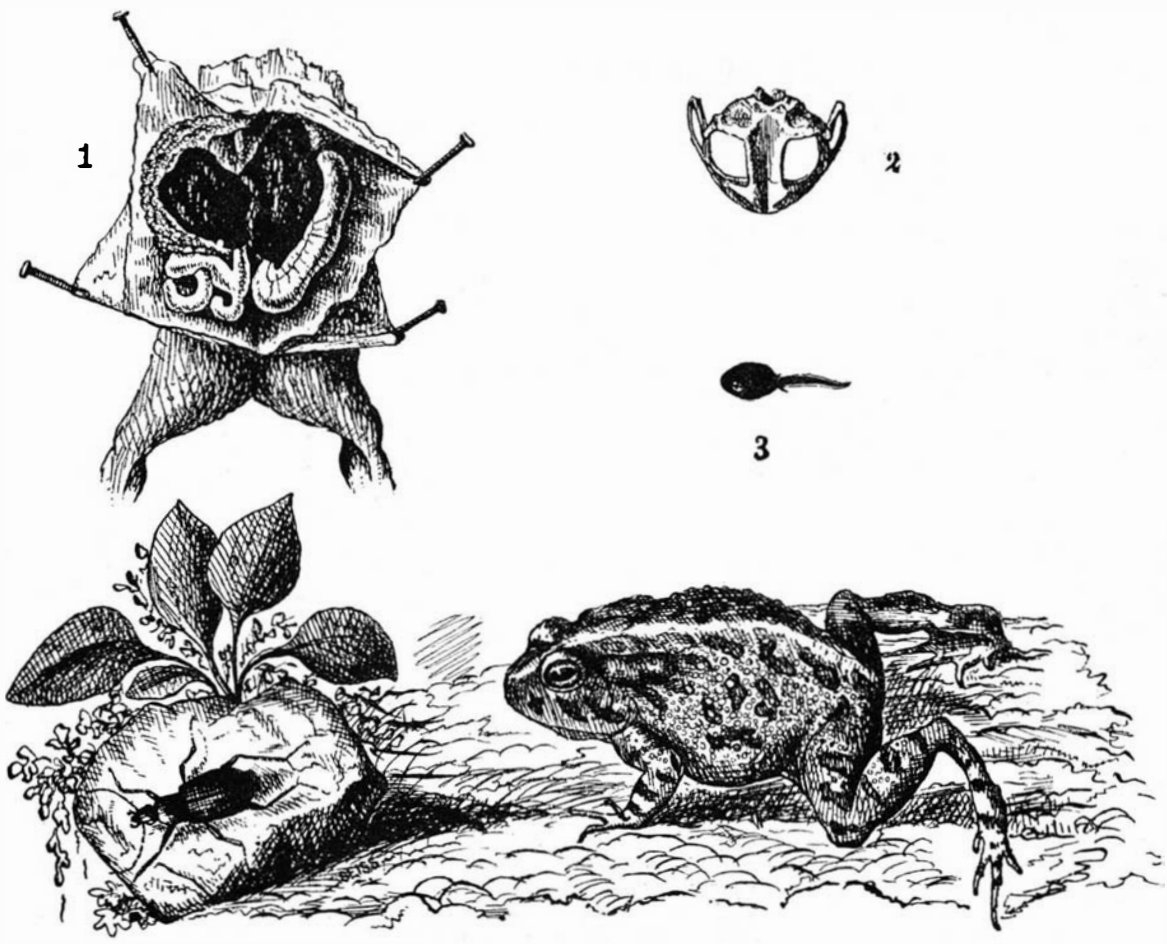
This, like other batrachians, is insectivorous, devouring almost any kind of insect with which it meets, not excepting bees and wasps, although some have supposed differently. I have in several instances induced it to seize and devour pieces of raw beef, by impaling the meat upon the point of a piece of thin wire, and passing it in a swinging manner before the toad.

The toad has often proved itself to be a good collector of entomological specimens, for many rare and interesting insects have been found by extracting the stomach and examining its contents. By this means insects, not supposed to be found in a certain locality, have, on dissection, been found within a toad taken in that same locality. The prevalent supposition that, by handling a toad, excrescenses will be produced upon the hands is entirely fabulous.

I have attempted to represent a toad creeping towards a beetle. This habit of creeping slowly upon its prey instead of always springing, I have also observed in various frogs (*rana*). Insects are sometimes frightened off by a sudden spring of a frog or toad before they can be captured, hence this habit of creeping.

Fig. 1 represents the internal organs of this *bufo*. Fig. 2 is the skull, viewed from above. Fig. 3 is the larva or tadpole.

C. FEW SEISS.



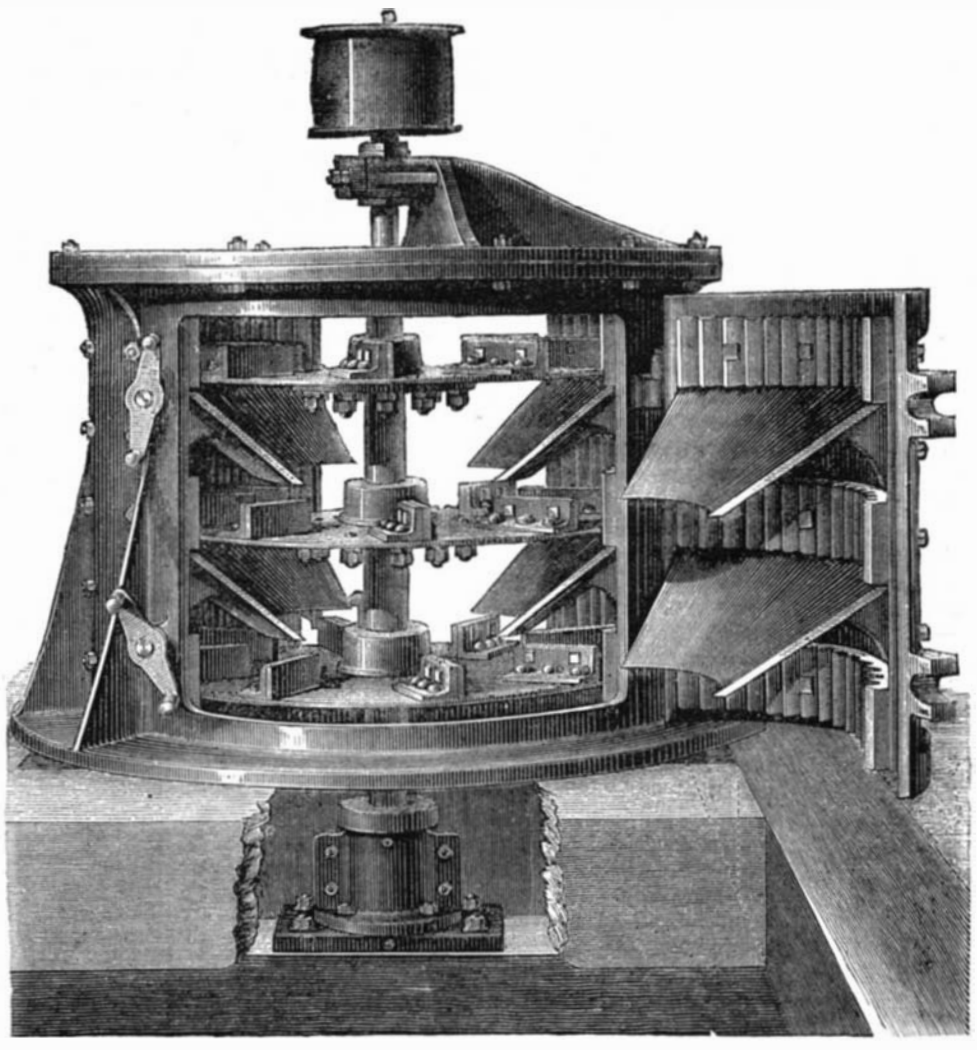
THE AMERICAN TOAD.

Cheap Coal and Water Supply.

Our manufacturers on the east branch of the Hoosac have been congratulating themselves on the abundant supply of water which they are now enjoying. This is like old times, when an equal and sufficient flow could be depended upon. The reason of this former affluence of water was that the native forests, as yet undestroyed, retained the water in the vast range of country over which they stretched, and rendered it gradually forth throughout the summer season. These growths of wood, when firewood was at so high a price, became, however, a rich source of income to our farming population, and consequently forests were ruthlessly felled and large portions of country laid bare to the burning sun; this soon absorbed their moisture, and in consequence the streams, deprived of their nursing mothers, speedily ran dry. But of late there has been a marked change in the market value of wood. Coal has fallen in its price to $4 75 per ton when delivered, and wood to from $2 to $3 per cord. Now, as a ton of coal goes much further in producing steam than a cord of wood, the latter material has given place in our factories to the former, and farmers, finding it of so little profit to hew wood on the mountain sides, have left off doing so. Consequently our young forests are springing up vigorously on every side, and the old localities are again being covered with a thick screen of verdure, which both attracts and retains moisture—hence the natural supply of water over which our manufacturers are now rejoicing.—*North Adams (Mass.) Transcript.*

THE VAPART DISINTEGRATOR.

We annex an illustration, from *Engineering*, of a disintegrating machine largely used in France. It consists of a cast iron case provided with two doors, which can be opened, as shown, for inspection or renewal of the various parts. Through the middle of the case runs a vertical shaft, with bearings at top and bottom, and carrying at the upper extremity a pulley by which the shaft is driven. Within the case, three disks are mounted on the shaft at equal intervals. On these disks are bolted a series of radial ribs, as shown. Around the inner side of the case, as well as on the doors, are placed strong cast iron toothed segments, and beneath each segment is placed an inclined and curved plate. The operation of the machine is as follows: The material to be disintegrated is fed in from the top and falls upon the upper disk, and the quick rotation of the latter drives the material forcibly against the corresponding toothed segments. From here it falls down the inclined plates, and is delivered on the middle portion of the second disk, where the same operation is repeated on it, as well as on the bottom disk, whence it is delivered into a hopper below. The disintegration can be carried to any desired extent



THE VAPART DISINTEGRATOR.

Ruins of New Mexico.

The following notes, by William H. Jackson, of Professor Hayden's survey, on the ancient ruins of New Mexico, and concerning a people about whom nothing is known, will be of interest to all readers:

Commencing with the first ruin, of the Pueblo Contado, as it is called, there are ten others along the cañon of the Chaos, two of them upon the bluff outlooking the cañon, and the others in the valley, all of similar workmanship, and manifestly the work of one people. They are remarkable in being dissimilar and immeasurably superior to any of the ruins yet discovered in America, or to any of the habitation of the present buildings. The large ruin in the Cañon-de-Chelly is of the same class, and is probably contemporaneous with them. The largest of the ten is the sixth, as we go down the cañon, called the Pueblo Bonits by Simpson, which is 540 by 310 feet in its diameter. The smallest is the ninth, and which is a regular parallelogram 78 by 62 feet. With but two exceptions all are built around three sides of a rectangle, with open court facing south and inclosed by a semicircular wall. One of the exceptions to this regular rectangular plan was the last one down the cañon, the Pueblo Penasco Blanca, of perfect elliptical shape, 496 by 363 feet in its diameter, and the other, Pueblo Bonits, was a perfect half oval or of an egg-shape divided along its greatest diameter. In all, the ground plan of each could be made out with perfect instructions, and in nearly all an elevation through three or four of their stories.

A marked feature was the large size of the rooms. On the second flooring, in the Pueblo Pintado, the rooms averaged 12 by 20 feet, some being as large as 14 by 25 feet square and 12 feet in height. In the Pueblo Penasco Blanca the average length of the rooms on the second floor was 20 feet, some being as large as 18 feet. In the other Pueblos the average height between floors was 10 feet. This does not apply to the first or ground floor, which had a similar height and was divided into much smaller apartments. These were evidently for storage purposes, as is the practice with the Pueblos at the present time.

In five of the ruins we found entire and perfect rooms, preserved from the destruction by the strength of the regas or rafters supporting the floor above them. These we examined with much care and interest, and regretted that we had not the means of digging into others, which are intact beneath the *débris* of fallen walls. In all the rooms there was a notable neatness of finish, particularly of the ceiling, which, in the case of Penasco Blanca, were covered with thin boards of pine somewhat larger, but of the thickness of an ordinary shingle. All the larger beams, ten to fourteen inches through, were cut off square and smooth. Some of the rooms were plastered perfectly white, probably with the same *yeso* the Pueblos and Mexicans now use. On the walls of one of the small rooms of the Pueblo Bonits were scratched the names of Lieutenant Simpson and R. H. Kern, dated August 1849, and looking as fresh as if but a day old. There were at least two doors or windows in every apartment, of an average size of 26

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by 42 inches. These were plumb to square, of equal width top and bottom, and in forming them the builders seem to have given their greatest care and attention.

A prominent feature in all these ruins were the circular rooms or *estufas*—their council halls or secret places for the practice of their ancient religion. The number of these from each Pueblo varied from but a single one up to as many as twenty-two; their average size was 25 feet in diameter, the largest being a trifle over 60 feet, and the smallest 15 feet in diameter. In two Pueblos these *estufas* had been divided into two or more floors, the beams still protruding from the walls. The interior walls were of the most perfect masonry and perfectly circular.

In all the ruined Pueblos the most remarkable feature was the skill with which the stone walls were built and which has enabled them to withstand for hundreds of years the ravages of human hands and the slower work of the elements. Commencing at the foundation with a width of 32 inches, each succeeding story was built a little less in thickness until the walls of the fourth floor are but 18 inches through, giving them a pyramidal shape and of such solidity that in some cases, although the floors have been crushed down and the crosswalks fallen, yet they remain firm and plumb nearly forty feet in height. They had their methods of laying the stone—big regular sandstone blocks of the size of two bricks, cut and ground to a uniformity—by alternate layers of these blocks with layers of very small and thin pieces of sandstone, generally three courses of the thin to one of the thick, and last by laying the entire wall of these excessively small pieces of thin sandstone. As an example of this last kind I measured off a square yard on the northern wall of the Pueblo of Chetto-Kethe, and counted the number of stones forming the surface. There were 450, each laid so close together that a knife blade could not be pushed between them, and not a particle of mortar of any kind appearing at the surface. This entire wall was 490 feet long, and originally fully 40 feet high and averaged 24 inches thick. Imagine the industry and patience of such builders. The interior of these walls were laid in with rougher stone, and with abundant clay mortar. Binding courses of pine sticks were laid in the wall, both transversely and longitudinally. Every doorway and window was framed with scrupulous exactness, and it would appear as if the plumb and square had been faithfully used in all their work.

Communications.

The Seventeen Year Locust.

To the Editor of the Scientific American:

H. J. Loomis, of Chesterfield, Ill., says, in the SCIENTIFIC AMERICAN of July 7, that what is termed the seventeen year locust appears every thirteen years. In 1829, 1842, 1855, and 1864 they appeared in that region. In Grundy county, Ill., they were numerous in 1854, and also in 1871. I read a few weeks ago that these locusts were appearing in great numbers, if I remember right, somewhere in Pennsylvania, and this is 1877. It does not correspond with either of the periodic appearances as noted above. Is it possible that Nature's operations are so widely variant in the same insect, in about the same latitude? One would think that a seventeen year locust, reasoning from analogy, would remain such in its habits, in obedience to the fixed laws of life; but if it be true that these three appearances of locusts (which by the way are not locusts at all, but cicadas) are one and the same species, can science reconcile or account for these wonderful discrepancies of their appearances, varying four years or more in different localities, and in latitudes not very widely apart? We think they must be different an ddistinct species. We regret we have not an entomological description of our seventeen year locust. One thing we distinctly remember, he had red eyes, which no other species of our acquaintance has. A specific description of a specimen of each of their appearances would determine the identity, or otherwise would show three species. Cannot the scientific readers of the SCIENTIFIC AMERICAN settle the question of identity?

Verona, Ill. R. K. SLOSSON.

Pumping with Tight Connections.

To the Editor of the Scientific American:

In response to your wish for some experimental data in proof of my assertion as to the advantage of a tight connection, I relate the following. In 1874 I was employed by the Boston and Providence Railroad, to go to Mansfield, Mass., to make some soundings for water, which was wanted in large quantities. I drove two 3 inch wells 100 feet apart. They were 21 and 23 feet in depth driven through 3 feet of iron ore, which was very close and solid, effectually excluding air. In testing the wells as to supply, I used a Knowles steam pump, 2 inch suction, 1½ discharge.

When ready to make connection I found I had no reducing coupling suitable, and I inserted the suction pipe inside of the well tube in the same manner, but could not run my pump more than 15 minutes without drawing air, the pump running 34 strokes per minute.

Next day I made a tight connection and set my pump in operation. I was astonished at the result. I cannot give you any data on the first trial, for I kept none except the number of strokes per minute and the length of time of the run. On the second trial the pump was in operation one week constantly, from Monday morning at 8:45 until Saturday night at 5:30, pumping 165,000 gallons per day of 24 hours. I have tried the same thing many times and the result has always been the same.

Waltham, Mass. J. R. SMYTH.

Raw Taste of Tobacco.

To the Editor of the Scientific American:

I have been a slave of tobacco for so long that I have given up the idea of ever stopping the use of it. There is so much of the plug tobacco that causes the mouth to become raw, besides containing hair, feathers, and other little dainties too numerous to mention, that I have determined to use none but leaf tobacco hereafter. Will you be kind enough to tell me, through your valuable paper, how to remove the raw taste from the natural leaf, and oblige a subscriber who fully appreciates the value of the SCIENTIFIC AMERICAN?

New Cumberland, Pa. J. W. F.

[ANSWER—We believe that the common method of removing the raw taste, that our correspondent complains of, is to soak the tobacco in urine. Tobacco thus treated and then sweetened with molasses dirt, is considered "lovely," the "solace" of mankind, "honey dew," etc.]

Eruption of a South American Volcano.

The eruption of a volcano, probably Cotopaxi, has caused serious damage in Ecuador. The *Comercio* of Guayaquil, of June 29, gives the following particulars:

"A volcanic eruption occurred in the interior at from 9:30 to 11 o'clock A.M., on the 26th instant. We do not know which of the volcanoes is in action, but suppose it to be Cotopaxi, which for a century past has had an eruption every ten years. On the day mentioned, from Babahoyo to Tumbez, detonations resembling the discharge of cannon were heard. At Yaguachi it was said the reports came from the north. At 6 o'clock P.M. of that day a heavy shower of ashes commenced to fall, and continued until this morning. A calculation has been made of the quantity of ashes which has fallen in thirty hours, and it is estimated that on each square kilometer of space 313 kilogrammes of ashes had fallen. A mineralogical analysis of the ashes is made with the following result: Volcanic ashes composed of exceedingly fine particles of lodestone, vitreous felspar, hornblende, and an amorphous substance. On account of the absence of acids in the ashes they are not likely to be injurious to the crops or cattle, as on previous occasions.

"The steamer Islay, on her way from Panama to Guayaquil, first noticed the fall of ashes at Manta, and continued to receive them till arriving at Guayaquil, from which it is inferred that the winds from the higher latitudes have carried them to a great distance. No doubt, as on other occasions, the ashes have been transported to a distance of two hundred leagues from the volcano which threw them out."

The authorities between Ambato and Guayaquil report that, at 10 o'clock on the morning of June 26th, a frightful noise was heard in Latacunga, which was followed immediately by a tremendous flood, which, taking the course of the rivers Cutuchi, San Felipe, and Yanayaco, and passing, washed the city to the chapel known as El Salto. The volume of mud and water was so great as to completely cover the hacienda Valle, including the distillery in front of Latacunga. The flood in its course carried with it many cattle, and, what is more sad, many human bodies. The bridge of Latacunga, the handsome bridge of Bolivar in Pansalco, those of wood of Culapachan and Patate, and that of masonry of Agoyan, were all destroyed. All of the haciendas situated on both sides of the river have suffered enormously, and the desolation is terrible and complete.

Renovating Grass Lawns.

It is astonishing how long a lawn will retain its verdure without assistance in the way of manure. No doubt a lawn gets impoverished in time by being continually cut; but still it seems to sustain little or no injury. The roots of grass appeared to be endowed with an extraordinary vitality, and the rains to which they are exposed recuperate them for the close cropping to which they are subjected, and perhaps the fact of the grass never being allowed to seed has also something to do with maintaining fertility. The vitality of grass roots is best exhibited in dry seasons. In the dry summer of 1868, I knew large trees to die through drought at the root, and many to be seriously injured; but though the lawn was as brown and dead-looking as if it had been scorched by fire, the grass was not killed. I thought it was in many places, for to all appearance the roots appeared shriveled up, as well they might be, being close to the surface, and the grass having been kept as closely shaven as a carpet till the drought came; but when the rains came in October it began to grow, and by next summer all traces of the drought had disappeared. It must not be supposed, however, that I approve of lawns being allowed to become exhausted; by no means. A starved sward is never a very green one, and greenness and freshness are everything in a lawn; and upon the whole it is not difficult to keep it in that condition, for, however neglected it may have been, it quickly responds to stimulating treatment. The best and most convenient plan is to apply artificial manure of some kind in the form of a top-dressing. Guano is good, but it does not produce the greenest verdure; soot surpasses it in that respect, and it is cheaper. It is not needful to top-dress the lawn annually, and when necessary most gardens should provide the materials. If all combustible rubbish in the way of prunings of trees, rakings of shrubberies, etc., be collected into a heap, they will serve not only to consume themselves, if set fire to, and produce a good quantity of wood ashes, but will reduce to ashes all the short grass that has come off the lawn, weeds, roots, and other rubbish, and at the same time burn a considerable quantity of soil, which may with advantage be mixed with the ashes and the whole applied to the lawn as a top-dressing. There is hardly anything better than this for grass, and its effects are more lasting than guano or soot alone, and it may be applied without fear of injury. Should the lawn be mossy, it should be well harrowed with a rake first, and then cleaned and dressed.—*Correspondent in the Garden.*

The New Metals Ilmenium and Neptunium.

About thirty years ago R. Hermann announced the discovery of a new metal, ilmenium, accompanying tantalum and niobium in various minerals, and closely allied to them in its general characters. Several years later he relinquished his claims to the discovery, in consequence of researches by Marignac in the same field leading to entirely different results. Later investigations have, however, strengthened his belief in the existence of ilmenium, and in the February number of Kolbe's *Journal für praktische Chemie* he not only brings forward results tending to establish the individual character of ilmenium, but describes a new metal neptunium, belonging to the same group, and occurring in tantalite from Haddam, Connecticut. As the quantities obtained are small, the characteristic reactions limited, and as the spectral properties cannot be made use of, chemists will naturally reserve their opinion till confirmatory observations have been made by some other well known investigator. The following are the essential results obtained by Hermann. The mineral was found to consist of equal portions of columbite ($ROMe_2O_3$) and ferro-ilmenite (RO_2MeO_2). By fusion with potassium bisulphate the hydrates of the metallic oxides were separated out in the following proportions: Ta_2O_5, 32·39; Nb_4O_7, 36·79; Il_4O_7, 24·52; Np_4O_7, 6·30; total 100.

The hydrates can be changed into double fluorides, and from the greater solubility of potassium-neptunium fluoride, it may be obtained free from tantalum and ilmenium salts but retaining a small quantity of the niobium salt; these, however, on being changed into niobate and neptunate of sodium, may be separated on account of the greater solubility of the latter. By fusion of the neptunate of sodium with potassium bisulphate and treatment with water, the hydrate of neptunic acid was obtained in a pure condition. Neptunium may be distinguished from niobium and ilmenium by its having, along with tantalum, the property of forming an amorphous insoluble precipitate on the addition of caustic soda to the boiling solution of the fluoride; the other two form crystalline and easily soluble compounds. The very soluble character of neptunium potassium fluoride as compared with the corresponding tantalum salt servcs to distinguish it from that metal. The reactions with phosphorus salts in the inner part of the Bunsen flame are the following: tantalic acid, colorless; niobic acid, blue; ilmenic acid, brown; neptunic acid, wine yellow. Addition of tincture of galls to solutions of the sodium salts give characteristically colored precipitates. The atomic weight of neptunium, determined from the double salt $4KFl+Np_2Fl_7.2H_2O$, was found to be 118. Hermann has also obtained ilmenium in the form of a black powder by heating potassium ilmenium fluoride with potassium chloride and potassium.—*Nature.*

The Hayden Survey.

The area to be surveyed includes something over 30,000 square miles, divided into three districts, lying mainly in Wyoming Territory, but trenching on Utah and Idaho on the west. Two of these districts, the Green River and Sweetwater, have as their southern line the parallel 41° 45′ (or about the northern boundary of Clarence King's survey of the fortieth parallel), and the parallel 43° as their northern line. They extend from longitude 107° to longitude 112°, and are separated by meridian 109° 30′, the Sweetwater Division taking the eastern portion and the Green River Division the western. The Snake River Division works an area extending as far north as 44° 15′, and having the same meridians at east and west boundaries. The organization of the Green River Division is typical of all. It is composed of the following persons: Henry Gannett, Topographer in charge; Dr. A. C. Peale, Geologist; J. E. Mushback, Assistant Topographer; F. M. Eastman, Geological Assistant; two packers and a cook. Mules are used both for riding and for the conveyance of the outfit; *i.e.*, tents, baggage, bedding, instruments, and rations. By using pack-mules we are rendered entirely independent of roads, and can move our camp to within a short distance of the mountain summit, and also feel sure that they will be able to endure a campaign where horses and ponies would be sure to fail us. All our mules have been in service since 1873, and after the first few days out fall into line like old veterans. It is amusing to watch them the first day. While the *aparejos* or pack saddles are being put on, they puff themselves out and hold their breath as long as the packers pull on the circingle. When the load is on and the mule allowed to go, the circus commences; and if any animal in the world knows all the inside mysteries of "bucking," it is a Western mule. Our packers, however, are tried men, and put the load on to stay, which fact the mule is not long in finding out, and after one or two mornings he travels along so demurely after the bell-mare that you can scarcely believe him the same animal. Packing is an art, and the head packer is an important person in the camp. He has charge of the constantly diminishing cargo which each morning has to be made up into "loads" of equal weights.

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He also has charge of the train on the march while the scientific men are at work in the surrounding hills and mountains. The plan of work is about as follows: After breakfast the head of the party leaves word for the train to travel 8, 10, or 15 miles in a certain direction, and then to camp while the scientific corps spends the time in occupying the stations of the day. These are generally the highest points in the region, from which the topography can be readily made out. All mountain peaks, spurs, junction of streams, and hills are located by means of angles in connection with angles taken from other stations. The station is located by angles on the primary points determined by the party of primary triangulation, which traverses all the districts. Contour and profile sketches of the surrounding country are made, and elevations taken with mercurial and aneroid barometers, and by depression or elevation angles are taken with the gradieuter. The geologist makes sections of the rocks, giving their position, character, and thicknesses, notes the absence or presence of mineral matter, and makes a sketch showing the areas occupied by the different geological formations. Besides this, the general character of the country and its agricultural capabilities are noted. By 4 or 5 o'clock the work of the day is generally completed, and the party turns campward, striking the trail of the train, which is followed until the camp fire is sighted.—*Correspondence of the New York Tribune.*

The Adulteration of Food.

We take the following extracts on the adulteration of food from an article which recently appeared in the *Evening Post:*

"While it is certain that needless alarm is frequently excited by exaggerated statements regarding food adulteration, there can be no doubt that many of the articles of food met with on our tables often contain foreign ingredients which are introduced either for the purpose of lessening their cost or improving their taste and appearance.

Flour is subjected to adulteration with other and inferior meals, such as rice, beans, rye, potatoes, and Indian corn, the addition of which cheapens the price and in some cases bestows a good color upon a damaged or inferior grade, or causes it to take up an abnormally large quantity of water. The addition of foreign meals to flour is practised, however, almost exclusively in Europe, as most of the substances of this class used have in this country a greater value than pure wheaten flour. A more probable illustration with us is the use of alum and mineral substances; the former is occasionally employed to impart a white color to the flour, the latter, which include sulphate of lime, kaolin, chalk, and bone dust, being used to produce increased weight. It has quite recently come to light that a flour containing ten per centum of a mixture of chalk, plaster of Paris, and barytes has for some time formed a steady article of export from Holland into other European countries. The presence of such substances as these can be detected by placing the flour in a long tube nearly filled with chloroform, shaking the mixture, and allowing it to stand, when the pure flour will rise to the top of the liquid, the heavier mineral adulterants sinking to the bottom.

Bread naturally contains the foreign ingredients added to the flour from which it is made; but in addition to these, other substances are sometimes used in its preparation. Alum is employed to prevent the action of the diastase upon the starch, and to prevent the bread from becoming sour and mouldy; and although this salt undoubtedly tends to accomplish these results and imparts a fine white appearance to the bread, its use is not justifiable. When taken into the stomach it is liable to occasion acidity and dyspepsia; furthermore, it prevents the solution of a large proportion of the gluten of the bread, thereby causing a decrease in its nutritious value. A far more reprehensible adulteration consists in the addition of sulphate of copper, which has the same effect on the color of the bread and on the diastase. Although this salt is but seldom employed, and then in very small amounts, its use is to be condemned in the strongest terms, as it acts as a virulent poison, and its effects are cumulative. A simple and delicate test for detecting the presence of copper is to moisten the suspected bread with a few drops of solution of ferrocyanide of potassium, which will cause a pinkish color to become apparent if the metal be present.

Pickles and preserves are often artificially colored. The deep green color frequently noticeable in the former is almost invariably due to the presence of a sort of copper (the sulphate or acetate), which is either directly added to them or is produced by using copper vessels in their preparation, both methods being recommended in several cooking books. This adulteration can be detected by allowing a piece of clean and polished iron to remain immersed in the pickling vinegar for a few hours; in presence of copper a thin coating of this metal will be deposited upon the iron.

The condiments used at the table are also frequently far from pure. Additional acidity is often imparted to vinegar by the addition of sulphuric acid, the use of which was formerly considered necessary in order to prevent its decomposition, and was allowed by law in Great Britain; but although the fallacy of this belief has been demonstrated, the practice is still resorted to. A few weeks ago five carloads of vinegar received in Washington from Chicago were found to contain over fifty-four grains of sulphuric acid per gallon, in the form of sulphate of lime, in addition to five grains per gallon of the free acid. On adding a little nitrate of baryta to vinegar containing sulphuric acid, a heavy white precipitate will be immediately formed.

The sophistications practised upon tea are large in number and often harmful in character. The greater part of the adulteration occurs in China, but the English and Americans appear to have become skillful imitators of the Chinese in at least some branches of this nefarious industry. Mineral and organic substances are used to increase the weight and bulk of the tea; fictitious strength is imparted to it by the addition of certain vegetable substances, and pigments are employed in order to produce a desirable color. The operation which is most generally carried on, at least in this country, is the artificial "facing" or coloring of teas. This practice is almost entirely confined to green teas, of which, it is said on high authority, but few grades reach the consumer in a pure state. The pigments most used for coloring green teas are Prussian blue, indigo, turmeric and china clay: the peculiar glossy appearance they frequently present being produced by means of black lead, talc, and soapstone. Other and far more dangerous substances, such as arsenide of copper, chromate of lead, and Dutch pink, are said to be sometimes employed. When hot water is poured upon a faced tea, the coloring matter present often becomes detached and either rises to the top or sinks to the bottom of the liquid, forming a sediment which can be readily recognized as a foreign body, especially by aid of a magnifying glass.

Coffee is probably more extensively adulterated than any article yet mentioned. When sold in the ground state it almost invariably consists of a mixture containing little or no coffee and a great deal of chicory and roasted grains, such as peas, beans, rye, and wheat. The addition of chicory is frequently defended on the ground that it improves the taste and quality of the coffee; but owing to its comparative cheapness, there is a great temptation to use an undue quantity of this substance, and unless the amount of the addition is specified on the packages (as is required in several European countries), it undoubtedly constitutes a true adulteration; moreover, chicory itself is very often mixed with foreign substances. Pure coffee will remain floating upon the surface of the water for some time, and fails to impart a perceptible color to it, whereas chicory and beans (especially the former) at once sink to the bottom and color the liquid decidedly. Other substances which also rise to the surface of the water can be easily distinguished from coffee by their appearance and taste. A simple test is to spread the coffee out on a slip of glass, slightly moisten it with water, and then touch the layer in different parts with the point of a needle; in this way the presence of soft, non-resisting foreign ingredients can be easily detected.

The artificial coloring of confectionery also merits consideration, owing to the important sanitary effects involved. One of the most common and deleterious substances used in the coloring of confectionery is chromate of lead, which is employed for the production of a yellow color. Red, another favorite hue, is obtained by means of cochineal, but such poisonous compounds as red lead and vermilion are also sometimes used for its production. Green and blue colors, which are fortunately less often met with, are usually produced by means of Prussian blue, Brunswick green, Scheele's green, etc., all of which must be classed as dangerous substances. These colors can be obtained by using vegetable dyes which are quite harmless; and although the tints are then less brilliant, this fact is certainly no excuse for resorting to poisonous pigments.

In most foreign countries effective means have been adopted to expose and prevent the adulteration of food, but with us little has been accomplished in this direction. In Europe boards of public analysis are appointed, who carefully examine suspected articles of food; here this duty usually devolves upon some member of the local Board of Health, whose time, as a rule, is fully occupied by other employment. During the last few years our Custom House officials have exercised commendable care in regard to the quality of the drugs admitted through the customs, and the question naturally arises: Should not at least equal importance be attached to the subject of the purity of the food sold by our grocers and consumed by our families?

Why are we Right-Handed?

Investigations which were very recently carried through by a French physician, Dr. Fleury, of Bordeaux, have adduced facts showing that our natural impulse to use the members on the right side of the body is clearly traceable to probably physiological causes. Dr. Fleury, after examining an immense number of human brains, asserts that the left anterior lobe is a little larger than the right one. Again, he shows that, by examining a large number of people, there is an unequal supply of blood to the two sides of the body. The brachiocephalic trunk, which only exists on the right of the arch of the aorta, produces, by a difference in termination, an inequality in the waves of red blood which travel from right to left. Moreover, the diameters of the subclavian arteries on each side are different, that on the right being noticeably larger. The left lobe of the brain, therefore, being more richly hæmatosed than the right, becomes stronger; and as, by the intersection of the nervous fiber, it commands the right side of the body, it is obvious that that side will be more readily controlled. This furnishes one reason for the natural preference for the right hand, and another is found in the increased supply of blood from the subclavian artery. The augmentation of blood we have already seen suggested; but the reason for it is here ascribed to the relative size of the artery, and not to any directness of path from the heart. Dr. Fleury has carried his investigations through the whole series of mammalia; and he finds that the right handed peculiarities exist in all that have arteries arranged similar to those of man. At the same time such animals, notably the chimpanzee, the seals, and the beavers, are the most adroit and intelligent.—*The Eclectic.*

Stereoscopic Relief in Microphotographs.

It is not improbable that the announcement of a prize being offered by the Photographic Society of Great Britain for the best microphotograph will act as an incentive to those who may be halting between two opinions concerning the production of photographs of this kind for the forthcoming exhibition. To those feeling an interest in practical microphotography, whether they be intended exhibitors or not, we purpose giving a few practical suggestions and hints regarding this branch of science, although in connection with a certain department about which little appears to be known —that of producing stereoscopic effects in the enlarged images of minute objects to be pictorially delineated.

It is commonly believed that in order to obtain stereoscopic microphotographs a binocular microscope is essentially necessary. From what follows it will be seen that not only is this instrument unnecessary for the production of that class of work, but that in a majority of cases better results can be obtained without than with such an appliance. It is necessary that in all descriptions of binocular photography both images should be photographed under precisely similar optical conditions. In the case of that form of binocular microscope which has attained the highest measure of popularity in this country, such conditions are not possible, because of the dissimilarity of the images, one of them having to be transmitted through a prism, in the course of which it undergoes two reflections, while the other is projected onwards without having to undergo such treatment.

There are two other forms of binocular instruments in which both the dual images are necessarily similar, namely those of Nachet and Stephenson. In these the deflecting prisms are constructed in such a manner as to render both images strictly identical. But, however perfectly they may be constructed, they are still open to two objections—that of not being much used in this country, and of necessitating the formation of each of the images with only half a lens, or, at any rate, with one half of the objective. In a method we adopted several years ago, these drawbacks are entirely eliminated.

A single-barreled or monocular microscope of any convenient form must have fitted to it a super-stage attached to the main stage, and capable of being influenced by the rectangular or mechanical adjustment of that stage. This superstage is so constructed as to allow of the small platform upon which rests the object slide to oscillate from right to left within a limited sphere. This is easily effected by having the slide holder pivoted at its two sides into guiding side pieces, the axis of motion being adjusted in such a manner as to nearly, if not quite, coincide with the object to be photographed.

The super-stage having been depressed at one side, a photograph of any suitable object is taken; after which, without moving the light, the camera, or any of the lenses, a tilt in the opposite direction is given to the stage, and a second photograph taken. The pictures obtained in this manner, when combined in the stereoscope, will show an amount of relief very astonishing.

The nature of the action by which this stereoscopic effect is obtained will easily be understood from the following illustration, which will approve itself to the ordinary, in contradistinction to the microscopic, photographer: At the distance of a few feet from an ordinary portrait camera let a bust or statuette be placed on a table. Now take a negative of the bust, and then, without moving the camera, or doing anything else than very slightly rotating the bust on its axis, let a second negative be taken. Prints from the negatives thus obtained will possess all the solidity of binocular pictures if examined in the stereoscope; nay, not only so, but unless special care have been taken not to move the bust too much when rotating it between the first and second exposure, the effect of relief in the stereoscope will be much exaggerated.—*British Journal of Photography.*

Improved Electro-Magnet.

M. Cance has called the attention of the French Academy to a new system of electro-magnets with multiple cores, similar to that of Camacho, but with series of small rods of soft iron substituted for the tubular cores, and enveloping the different coils. The rods are all put in contact with the breech of the electro-magnet, and strongly fastened at their base with a bronze collar, so as to make one solid piece. This arrangement is said to offer the following advantages: 1. Retaining permanent magnetism very little (as the demag netization of the rod is almost instantaneous). 2. Giving a sphere of lateral attraction as extensive as may be desired (since it is in relation to the number of rod cores). 2. Easier construction than that of electro-magnets with tubular cores. The sole inconvenience is that the system gives pretty strong sparks of extra current; but with systems of interrupters by deviation from the main circuit, or condenser, the evil may be obviated.

A Remedy for Bed Bugs.

A correspondent writes to the *British Medical Journal* as follows: "The best remedy for bugs in hospitals is a bug-trap made by boring a series of holes in a piece of wood with a gimlet, and placing this under the mattress of each cot. The piece of wood is to be placed periodically into a basin of boiling water. This is an Indian hospital plan."

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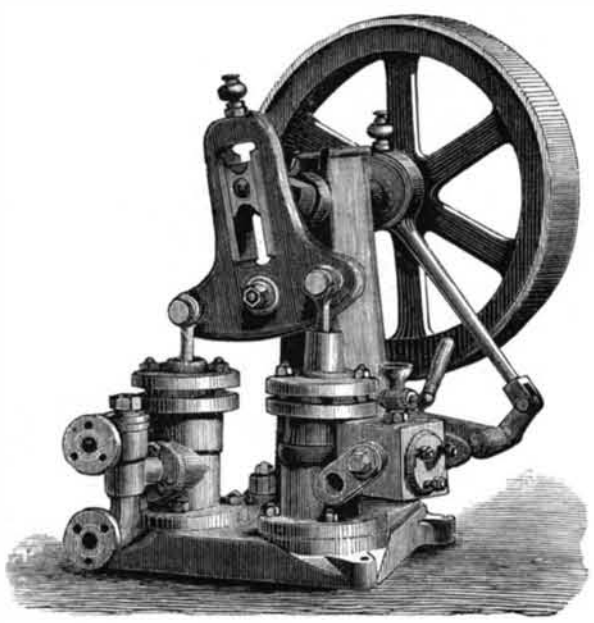
NEW PUMP.

The novel pump illustrated herewith may be operated either directly or by steam, by the intermediation of a belt or by hand. The advantages are its solid construction, the vertical movement of its pistons and the small motive power required. When steam is used, but one of the two pump bodies acts as a pump—the other serving as a steam cylinder to operate the machine. If the fly wheel is replaced by a pulley, and the steam cylinder by a pump cylinder, the capacity of the pump obviously becomes doubled. The normal speed is between 60 and 120 revolutions per minute. The weight is 303 lbs. when steam is directly used, or 242



lbs. when the belt pulley is substituted for the fly wheel. When single the capacity of the pump is from 2 to 4 gallons.

The apparatus is the invention of Mr. A Schmid, of Zurich, Switzerland. We take our illustration from the *Revue Industrielle.*

The Black Fly in the Adirondacks.

There is such an insect as the black fly in the Adirondacks. He is a quiet, orderly little fellow, a hard worker, who goes steadily about his business, and earns his living by constant application. There is much to admire in this little insect. In the first place, he is industrious; he is also a generous liver; he is orderly in his habits; he goes to bed regularly at sunset, and arises regularly at sunrise. We think that he is a little more regular in getting up than he is in going to bed. He is also friendly to man. He will cleave to you closer than a brother. The constancy of his affection is remarkable. Once having formed an attachment he never deserts you, but clings to you until death do you part. He is not by any means a gourmand. He has a taste, and discriminates. His favorite feeding spot is just back of the ear, although in case of necessity he is satisfied with the nose. He likes a large nose, and we have never seen one so small that he could not make it larger in less than two days. We saw a nose last summer—at least, we suppose it was a nose—the man who owned it said it was—that was so enlarged that the gentleman expressed grave doubts as to his ever being able to take it home with him. We are inclined to think that he succeeded, for when we came out we heard of that nose until we reach Martins, where we were told it took the stage for Plattsburg.

But to sober statement. The black fly is not a very troublesome insect. It ordinarily disappears the first week in July. In wet seasons it tarries a week or two longer. Care in selecting your camp ground, a piece of fine muslin three yards square to hang in front of your lodge, and a bottle of tar and oil for emergencies, give ample protection not only from black flies, but from the mosquito and gnat, which are, we think, far worse. It is the unanimous voice of our family that we have suffered more from mosquitos in Connecticut and Massachusetts, yes, and in the city of Boston even, than we have in the Adirondacks. With the precautions that we have suggested, and the exercise of a moderate amount of ingenuity, a party will not be greatly troubled.—*Golden Rule.*

Oyster Culture in France.

Under the fostering care of the Government, oyster culture in France is becoming more and more productive. A recent report by M. Bouchon-Brandely to the Minister of Marine contains a description of nearly thirty different localities, embracing some hundreds of beds, where the industry is carried on. One of the most curious facts in the report is that at Courseulles the oysters are actually trained to keep their shells closed, and thus retain their freshness while being carried to market. As regards the quantity of oysters which a small bed will produce, the following statistics may be quoted At Grand Camp there were, at the time of M. Brandely's visit, 3,000,000 of oysters ready to be delivered for consumption. In 1875 the owners of a bed at L'Orient sold 5,500,000 oysters, 2,500,000 of which were ready for consumption. In an establishment at Le Breneguy 4,401,000 dredged oysters were placed on the beds in 1875-6, of the value of 118,425f., and in the same period 7,538,150 oysters were sold out of the same beds, valued at 202,801f. The difference between these two figures represents, to a certain extent, the annual reproductive powers of the beds. The number of spat sold during the same time, either to the establishments on the coast or to strangers, and resulting from the clearing of the tiles used for collecting, was 26,176,309, representing a value of 192,385f. The growth of the oyster may be estimated from the fact that in 1873 there were placed on the beds at Regneville 83,000 young bivalves, measuring only two or three centimeters across. In 1874 no less than 65,000 of these same shellfish were sold in the markets, measuring seven to eight centimeters in diameter. The collectors used for catching the spat or infant oysters have been greatly improved during the last few years.

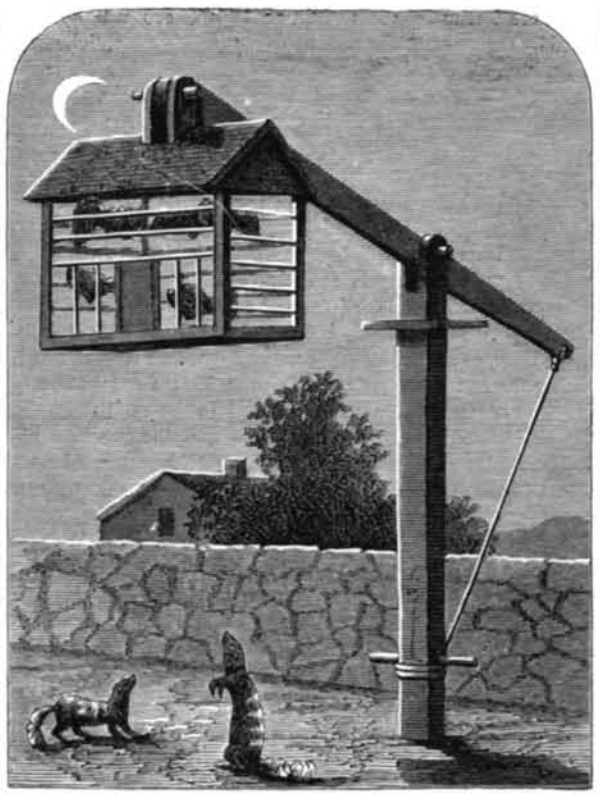
Portable Electric Light.

An ingenious little electric light apparatus has been invented by a Mr. Facio, of Paris, and is applicable to watches, walking sticks, and such like. The watch, for instance, to which it is applied, is united by a chain to a link bar, which may be placed in a buttonhole; another chain communicates with a pile which may be carried in the waistcoat pocket; to the link bar another chain is attached in communication with a receptacle or box containing wick, and a "Geissler" tube, which will transmit the spark produced by the electricity. Thus the time can be seen in the dark. The apparatus is composed of other conducting chains coming from the pile, and of a receiver which may be perfectly independent, the receiver being provided with a wick or bobbin, and the receiver may be made like a locket or other article, if desired; communication between pile and locket or other article may be produced by means of a button or other suitable appliance placed in any convenient position. The chains may be formed or composed of two wires and surrounded by insulating material, which latter may be covered with some precious metal or other material, as fancy or taste may dictate. The lighting material may be carried by the watch itself, or the light-generating apparatus may be provided with a case to hold the watch or other object to be lighted up, in such manner that the glass which covers the aforesaid case will receive the action of the lighting tube containing the "Geissler" tube, and the case itself will be independent of the object to be lighted.—*Exchange.*

IMPROVED CHICKEN COOP.

The object of the invention herewith illustrated is the preservation of chickens from the depredations of animals that prowl around during hours when the coops cannot be conveniently watched.

As shown in the engraving, an upright post bears upon its upper end a bar that is pivoted at the center. To one end of this bar is attached the coop, and to the other end a cord or line is fixed. When it is desired to place the coop in a position of safety, it is sufficiently raised by pulling on the cord, and is then held in place by belaying the cord to a cleat attached to the lower portion of the post. The at-



tempts of marauders will be futile to molest the poultry so protected.

This invention was patented June 5, 1877, by Robert L. and Nancy J. Todd, of Shamrock, Mo.

Iron Furnaces.

The whole number of completed furnaces in the country at the close of 1876, which were either active or capable of being transferred to the active list on short notice, was 714, against a similar total of 713 at the close of 1875. Ten new furnaces were completed in 1876, and 9 old furnaces were abandoned. The greatest activity in the erection of new furnaces has been shown in the Hocking Valley, in Ohio, where several bituminous furnaces have been built since the beginning of 1876, while others are now in course of erection or definitely projected. Of the furnaces which were built in 1875 and blown in in 1876, one of note was the Centennial furnace of the Cambria Iron Company, 75 feet high by 20 feet at the bosh. Of 714 completed furnaces at the close of 1876, 236 were in blast and 478 were out of blast. Of 713 furnaces at the close of 1875, 293 were in blast, and 420 were out of blast. The productive capacity of the furnaces of the country is at least twice the actual yield of either of the last two years. The consumption of pig iron in 1876 was equal to that of 1871, when the "iron famine" began.

SPELMAN'S IMPROVED ROWLOCK.

The improved rowlock herewith illustrated is claimed to be so constructed as to reduce friction between it and the oar to a minimum. The inventor informs us that it mate-

rially increases speed in rowing, and that, while it is specially applicable to racing boats, it is equally well suited to boats to the gunwale of which it is attached instead of upon outriggers.

The construction is exceedingly simple and scarcely needs description. The lock is made square, with an opening sufficient for the admission of the oar, the loom of which completely fills the inclosed space. Upon a side bar of the lock is a journal which works in the pin block, A. Said pin block, in turn, works upon the pin, B, which is secured to the outrigger or to the gunwale by the nut shown. The hole in the pin block for the lock journal is on the inboard side of the main pin.

Patented through the Scientific American Patent Agency, May 15, 1877. For further particulars address the inventor, Mr. William Spelman, 37 Portland street, Portland, Me.

Ice Water.

The Cincinnati *Commercial* has recently published a series of articles pointing out the evil effects of ice water, and condemning its use in the strongest terms. In one of its articles it says:

A man, who in a state of perspiration, with the sweat oozing from every pore in his skin, should suddenly strip off his clothing and shut himself up in a refrigerator would be set down in public estimation as a natural fool, who defied Providence itself to save him from death. Such a thing actually happened in this city a few years ago, and the man was taken out of his icebox dead as a herring and stiff as a pikestaff.

Ice water arrests digestion, if it does not absolutely drive out all animal heat, and it is not resumed till the water is raised to the temperature required to carry it on.

Habitual ice water drinkers are usually very flabby about the region of the stomach. They complain that their food lies heavy on that patient organ. They taste their dinner for hours after it is bolted. They cultivate the use of stimulants to aid digestion. If they are intelligent they read up on food and what the physiologists have to say about it—how long it takes cabbage and pork and beef and potatoes and other meats and esculents to go through the process of assimilation. They roar at new bread and hot cakes and fried meat, imagining these to have been the cause of their maladies.

But the ice water goes down all the same, and finally friends are called in to take a farewell look at one whom a mysterious Providence has called to a clime where, so far as is known, ice water is not used. The number of immortal beings who go hence to return no more on account of an injudicious use of ice water can hardly be estimated.

The article proceeds to show that in numberless cases fine teeth are totally destroyed by its use. It chills the teeth and cracks the enamel, then follows rapid decay and frequent visits to the office of the dentist.

In conclusion the article says: These remarks seem to be necessary, because ice is abundant and cheap this year, and the water drinkers are increasing in numbers, through the missionary efforts of the disciples of Francis Murphy. There is no objection, certainly, to the exclusive use of water, if taken as the Creator intended it should be. It is the excessive use of water, reduced below its average temperature with ice, that is to be condemned. It is an abuse of the stomach to use it, as it is an abuse of the stomach to put into it fluids that inflame its coatings and finally eat them away. We must put ice water and whiskey into the same *index expurgatorius.* They should be banished from private tables and banqueting halls, or used only to preserve articles of food in pickle or in the refrigerators.

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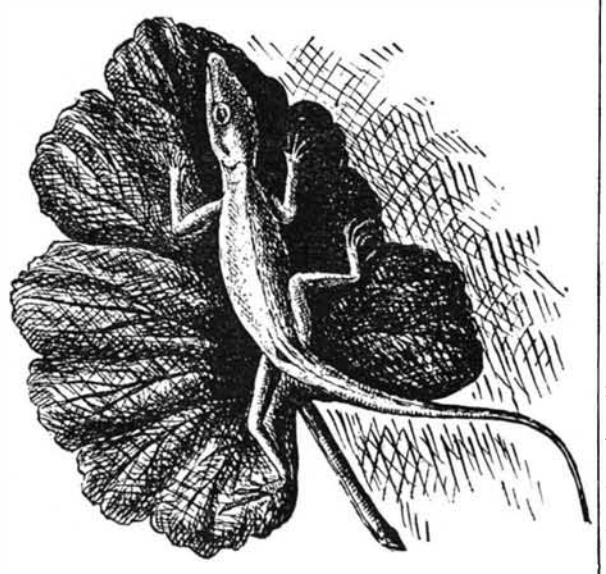
THE CAROLINA LIZARD.

This little lacertilian reptile, of the family *anolidæ*, is known to herpetologists by the name of *anolis principalis* (Linnæus). It is the *anolius Carolinensis* (Cuvier) of Holbrook. It has been called a chameleon. It does not, however, possess the prehensile tail and elongated and extensile tongue of the true chameleon, but resembles it only in the changing hues of its skin.

The specimen in our possession, upon which the few following observations were made, was captured in Florida. Its prevailing color is grayish brown, with a slight greenish tint. In the night, when in a state of repose, the color has always been whenever observed, of a clear bright green above; the labials and inferior parts white, or grayish white. A few times only during the day has it assumed the green hue, yet this is the common color of the Carolina lizard when in a wild



state. The reason of this may be want of light-colored and green insect food. I have seen it of a uniform grayish-brown color above, with a few spots of clear green dispersed over the body. At one time it changed from lead-brown to clear, bright green, after it had crawled and remained upon some geranium leaves for a few minutes. It retained this color for over ten minutes, when, without quitting the leaves, it gradually faded into a uniform grayish-brown.

The inferior surface of the epidermis of this lizard seems to contain numerous minute glands or chromatophores, by means of which the animal can, by secreting pigments into them, or withdrawing the same, change from one color to another. Thus, when all pigment is entirely withdrawn from the chromatophores, the whole upper part of the animal is bright green colored; when partly filled, grayish-brown with a greenish tinge; and when entirely filled, dark grayish-brown approaching to lead color. When one portion of the pores is empty and the other filled, the animal is bi-colored, or spotted with green and grayish-brown.

The assertion that every scale of the animal is furnished with sets of muscles, and that the change of color is produced by the action of light alone, is at best doubtful. On the inner parts of the scales of the epidermis I observed numerous minute glands or ducts, but no separate muscle attachments.

Before the old skin is about to be cast from the head, it becomes whitish in color on the occipital and frontal regions, and around the orbits. From the anterior part of each eye, also around the eye, and extending to beneath each nostril, the skin is broken by forcing outward the eyes, and the muscles around them. The edge of the skin is then observed to spring loose from the occiput, after which it is pushed off from the entire head by the fore feet of the lizard.

After the skin of the head had been removed, the skin of the new tail became lighter in color, and then parted along the dorsal line, when the whole of it slipped from the tail, a longitudinally hollow piece. When purchased our specimen was minus part of its tail, but a new one soon began to sprout, and now, an inch of new tail has been developed.

Our lizard is an expert fly-catcher, and it feeds almost entirely upon common house flies. It has eaten several Croton bugs (*ectobia germanica*), also small beetles, day flies, moths, and butterflies. It does not swallow its prey whole, in the manner of a frog, but tears and mashes it with its teeth and jaws, before swallowing. It drinks often, licking drops of water from the leaves, and from the sides of its cage.

It became quite excited on seeing its reflected image in a small looking glass, and made a bold advance towards it, at the same time erecting and depressing its head rapidly. This nodding motion I have also observed in the horned toad (*phrynosoma cornutum*, Harlan). As it is practised only at the meeting of individuals, it is reasonable to suppose it to be an action of greeting, or, in other words, a how-do-you-do nod.

From that remote period in the great chain of human development, when our forefathers were yet lizards, even to the present enlightened period, a nodding of the head was and is an action of salutation or friendly greeting; and although forgotten in many intervening links, it still survives!

A Move in the Right Direction.

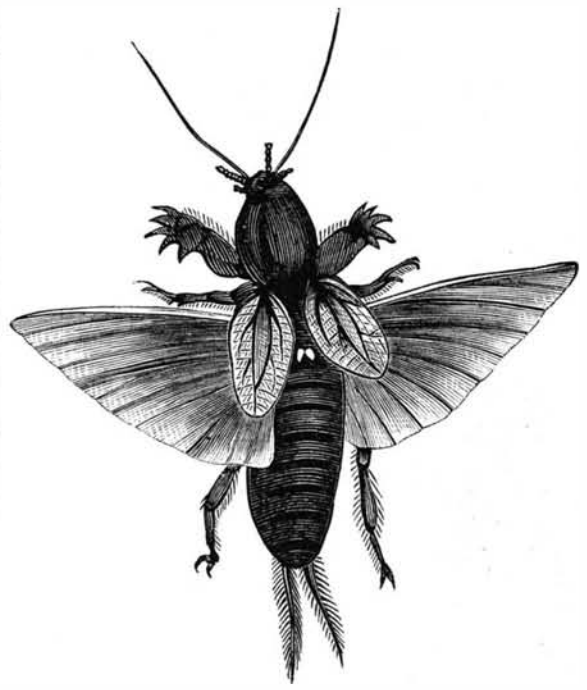
The Massachusetts Society for Promoting Agriculture has offered a series of prizes for the encouragement of tree planting in this State—the awards to be made 10 years from the 1st of March next for the best results produced in the interval. The white ash, the European larch, and the white and Scotch pine are the varieties especially favored. Something has been done already toward promoting a new centennial growth of trees, and the inducements here offered will give another impulse to the work. Mr. Sargent, of the new Arboretum of Harvard College, estimates that over 1,000,000 trees will be planted in Massachusetts this year. In Connecticut the General Assembly of this year gave public sanction and encouragement to the same enterprise by exempting from taxation all plantations of timber trees to be thereafter planted, for a period of 10 years after such trees have grown to an average of 6 feet in height.

THE SEA MONSTER.

We are indebted to Lieut. W. P. Haynes, of H.M.S. *Osborne*, for the sketch of the sea monster seen by the officers and crew of that vessel off the north coast of Sicily on the 2d inst., notice of which we gave in the SCIENTIFIC AMERICAN for July 14. In a letter accompanying the sketch he says: "My attention was first called by seeing a long row of fins appearing above the surface of the water at a distance of about 200 yards from the ship, and 'away on our beam.' They were of irregular heights, and extending about 30 or 40 feet in line (the former number is the length I gave, the latter the other officers); in a few seconds they disappeared, giving place to the fore part of the monster. By this time it had passed astern, swimming in an opposite direction to that we were steering; and as we were passing through the water at 10½ knots, I could only get a view of it, 'end on,' which I have shown in the sketch. The head was bull-shaped, and quite 6 feet thick, the neck narrow, and its head was occasionally thrown back out of the water, remaining there for a few seconds at a time. It was very broad across the back or shoulders, about 15 or 20 feet, and the flappers appeared to have a semi-revolving motion, which seemed to paddle the monster along. They were about 15 feet in length. From the top of the head to the part of the back where it became immersed, I should consider 50 feet, and that seemed about a third of the whole length. All this part was smooth, resembling a seal. I cannot account for the fins unless they were on the back below where it was immersed."—*London Graphic.*

THE MOLE CRICKET.

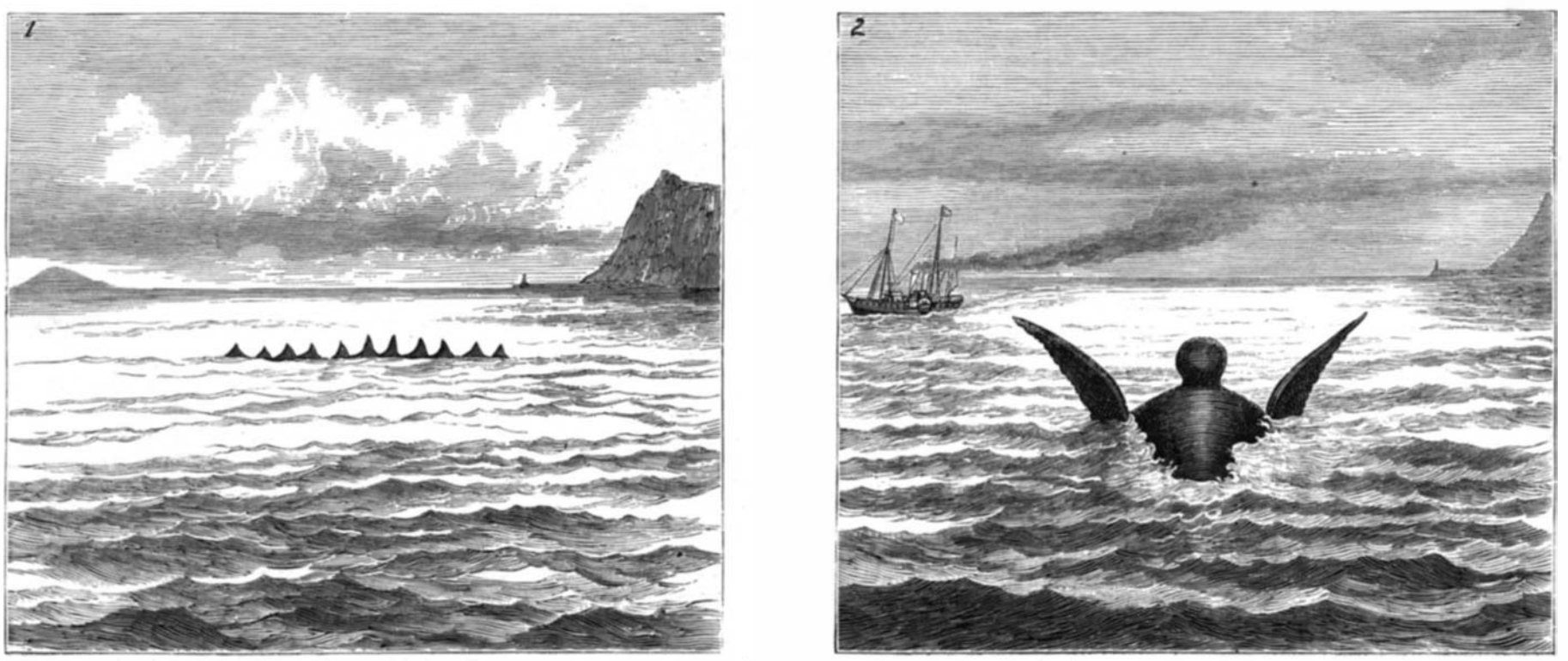
This insect is one of the most curious of all the *orthoptera*, to which order earwigs, crickets, grasshoppers, cockroaches, locusts, and the strange looking leaf and stick insects also belong; it is widely distributed over the world, from the torrid zone to the arctic circle; allied species inhabiting Java, China, Australia, Van Diemen's Land, North



and South America, and even Melville Island. It has been variously called eve-churr, churr worm, jarr worm, and crocker, names derived from its peculiarly jarring song; also fen cricket, earth crab, and mole cricket, the last being by far the most appropriate, and that by which it is generally known. With its powerful fore limbs it burrows underground, raising ridges in its progress. Its shape is long and cylindrical (a full-grown specimen measures 2½ inches in length by barely half an inch across the thorax), just that best fitted for locomotion through long narrow galleries; its color is a rich, dark, velvety brown of various shades, its thorax is very hard, and so formed that the head can be withdrawn into it, much after the manner of some tortoises; its whole body is covered with fine down. It has a long sensitive pair of antennæ or horns projecting in front of its head, and another pair on its tail, projecting backwards, also very sensitive; and as it moves with equal facility either forwards or backwards, should danger threaten from front or rear, it is ready to escape without turning round, an operation which would be difficult or almost impossible in its narrow tunnels. Like all the crickets and grasshoppers, its nearest allies, its hind legs are formed for jumping; though perhaps not often employed for this purpose, they form the ordinary locomotive organs of the animal, both below and on the surface of the ground; the middle pair being comparatively weak, while the fore pair are carried raised up.

The fore limbs are rarely used in walking, but are the tools with which the insect burrows. They bear a very close outward resemblance to the fore pairs of a mole.

The mole cricket is furnished with two pairs of wings, the



A SEA MONSTER.

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upper pair being small and serving as covers for the lower ones, which, when expanded, measure two and a half to three inches from tip to tip. They fold up very much in the manner of a lady's fan; and when in this condition, the points project somewhat beyond the end of the body.

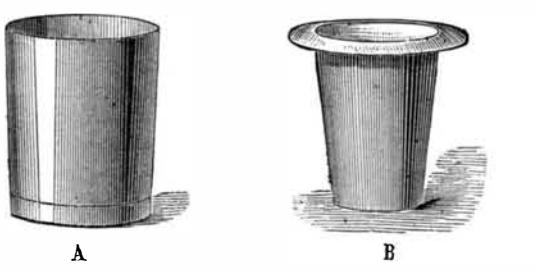
In May or June the female lays 300 or 400 eggs, which are about the size of turnip seed, but oval and yellowish, in a nest which she makes for the purpose underground, and which is thus described by Gilbert White: "There were many caverns and winding passages leading to a kind of chamber, neatly smoothed and rounded, and about the size of a moderate snuffbox. Within the secret nursery were deposited near 100 eggs, of a dirty yellow color, and enveloped in a tough skin. The eggs lay but shallow and within the influence of the sun." In a few weeks, according to the heat of the weather, the young are hatched. At first they are very small creatures, somewhat resembling black ants, very active and voracious in their habits. They grow rapidly, changing their skins three times before winter, when they hybernate, and, according to Rösel, cast a fourth skin during this period. The warmth of spring revives them, when they appear, having the rudiments of wings; and after one more change they become perfect insects, possessed of ample wings and in all respects similar to their parents.

Though having such large wings, the mole cricket does not appear to make as much use of them as might be expected. They never fly by day, remaining concealed in their burrows, but towards evening they may be found sitting at the mouths of the tunnels, uttering their "low, dull, jarring note," caused by the friction of one wing case over the other; and it is at this time, and during the night, that they are occasionally found upon the wing.

So destructive are these insects that they have been known to destroy a sixth, nay, even a fourth part of a crop of young corn. They are particularly fond of barley, young peas, and beans, and Mr. Brackenridge says "nothing in the herbaceous way is proof against its ravages." Many and various schemes have been suggested for their extirpation. Louis XV. even purchased a recipe to kill them by first filling their burrows with water, and then adding some oil. Turpentine, soapsuds, soot, lime, and similar materials have also proved efficacious.

A SELF-COOLING GOBLET.

M. Toselli proposes the convenient little device illustrated herewith for cooling a tumbler of water by refrigerating mixtures. It is well adapted for localities where ice cannot readily be obtained, as by its aid a glass of fresh cool water can be produced in a few moments.



A is a simple cylindrical vessel which holds the water or beverage to be cooled. B is a smaller vessel with a flange around the rim, and which is placed within the goblet or tumbler, A. In the inner vessel, B, is dissolved the refrigerating mixture, about five ounces of nitrate of ammonia in water. The solution is agitated and in a few minutes the cold produced is said to be sufficient to lower the temperature of the water in the outer vessel some 50° Fah. The salt can be used over and over again, indefinitely, as it is merely necessary to pour the solution on a flat dish, when re-crystallization will take place as evaporation progresses.

The Great Lick Telescope.

Richard S. Floyd, one of the trustees of the Lick Trust, has just returned from an extended European tour. During his absence he has talked with many scientific men of this and other countries, but almost invariably found them afraid to commit themselves to an opinion as to whether a greater success can be obtained with a reflecting or refracting telescope. Professor Newcombe, of the Observatory in Washington, after his visit to Europe to look into this matter for Mr. Lick, reported warmly in favor of a gigantic refractor, and forwarded estimates as to cost. He has since changed his opinion, however, and now recommends a silver-on-glass reflector of about seven feet diameter. Ross's, Herschel's, and other celebrated telescopes have speculum metallic reflectors, which have until lately been considered the best. Now the palm is claimed for an invention of Leon Foucault's by which silver in solution is deposited on glass. Foucault made a reflector upon this system about thirty-one and one fifth inches in diameter, and excellent work has been accomplished with it. After his death a reflector upon his plan about four feet in diameter was constructed for the observatory. Owing to some not thoroughly explained cause, this has not proved a success, and another of the same dimensions is being constructed to replace it. Great interest is manifested in the result of this second experiment, which cannot be proven for a year yet. Dr. Huggins, the well known astronomer, also favors a large reflector, as it is better for spectroscopic analysis, his favorite study. It is natural that he should prefer a reflector, as he desires to have the field of physical astronomy enlarged.

Theoretically, a reflector of 4 feet in diameter is about equal to a refractor of 26 inches. The Ross reflector is 6 feet in diameter, only 4 feet of which are effective, and so far it has not been proven that more than 4 feet of a reflector can be made effective. The great trouble with the reflector is that it is very sensitive to atmospheric changes, while with the refractor the difficulty lies in the secondary spectrum. The object glass of the refractor is composed of two glasses joined, the outer being of crown glass, the inner of flint. Rays passing through the crown glass are refracted. The consequence is that perfect achromatism is impossible, and the difficulty of compensating these refractions increases with the size of the object glass. The largest refractor in the world is that in the Washington Observatory; it is 26 inches in diameter, and is an excellent instrument.

Mr. Floyd said that, after as careful an examination as he could make, he is inclined to believe that the best interests of the fund will be served, to have constructed a larger refractor than any yet made. This ought not to cost complete more than $150,000. Then there will be a subsidiary refractor, about four feet in diameter, supplied with both silver-on-glass and speculum metal mirrors. Such an instrument has been offered, or rather parties have agreed to construct one, for about $20,000. Tell, of Paris, will undertake to make crown and flint glass disks for the object glass of a forty inch refractor for $20,000—stipulating that he shall be allowed two years for construction.—*San Francisco Bulletin.*

Preventing Suffocation by Smoke.

I will give some suggestions for the prevention of suffocation by smoke. A pillow case, well saturated with water, and having a small hole torn in it to look through, placed loosely over the head, will be found an admirable impromptu respirator in the densest smoke. I am indebted for the idea to Vice-Admiral Jerningham, who told me how, when he commanded the Cambridge training ship at Plymouth, he made his first experiment with this pillow case respirator. He had 12 lbs. of loose powder exploded in a confined part of the ship, which, although screened off with fear nought, emitted so dense a smoke that those outside had to lie down on the deck. A common pillow case, with a small eye hole, was placed over the head of a man, who, with the hose in the hand, went inside and remained ten minutes, when, to assure his friends outside of his safety, he sang a comic song.—*W. H. Lewis, in London Times.*

Fight between a Turkish Monitor and Four Torpedo Boats.

A most interesting affair occurred on the Danube here during the operations attending the passage of the Danube—a fight between a Turkish monitor and four Russian torpedo boats. It was somewhere near the mouth of the Aluta. This monitor had been giving the Russians a good deal of trouble, and showed an amount of activity and energy very unusual with the Turks, continually shelling the Russian batteries, and destroying the boats. The Russians accordingly determined to destroy it.

Four torpedo boats were prepared and sent against the monitor. Hiding behind an island, they laid in wait, and when the vessel was steaming past suddenly darted out from their hiding place, and bore down on her in broad daylight. This monitor, it soon became evident, was handled and commanded in a very different manner from others with which the Russians have had to deal here. With wonderful quickness and skill she was prepared for action, and, nothing daunted by the fate of others, made a successful defence against the four terrible enemies, a defence of which the Russians speak with the greatest admiration.

Her commander began by likewise thrusting out torpedoes on the end of long spars, thus threatening the boats with the danger of being blown into the air first, at the same time opening a terrible fire on them with small arms and mitrailleuses. He beside manœuvred his boat in a most skillful manner, with a dexterity and address which, with the torpedoes protecting, made it impossible for the Russian boats to approach sufficiently near. He beside tried to run them down and very nearly succeeded in doing so. The reason soon became evident. The commander was a European, whom the Russians believe was an Englishman, and who directed the movements from the deck. He was plainly visible all the time, and was a tall man, with a long, blonde beard, parted in the middle. He stood with his hands in his pockets, giving orders in the calmest manner possible.

The torpedo boats continued their attempts for more than an hour, flitting round the monitor and seeking the opportunity to get at her, but without success. The monitor was equally active in trying to run them down, avoiding a collision by quick and skillful movements, backing and advancing, turning, and ploughing the water into foam as she pursued or avoided her tiny but dangerous adversaries—a lion attacked by a rat. At one moment one launch, in rapid manœuvres, found itself between the monitor and the shore, with no great distance between them. The monitor's head was in the other direction, but her commander instantly began backing her down on the torpedo boat, with the intention of crushing it against the bank.

Just at this moment the engineer of the launch was wounded. There was some confusion and delay in starting the engines, while the current carried her head aground in such a position as to render escape impossible. One of the crew sprang out into the water and pushed the ground, while another started the engines just in time to escape with a scrape, the shave was so close. One Russian officer sprang ashore, and seeing the captain of the monitor coolly standing on the deck with his hands in his pockets emptied his revolver at him, three shots, at a distance of not more than forty feet. The captain of the monitor, in answer, took off his hat and bowed, not having received a scratch. Later, however, the gallant fellow seems to have been killed or wounded, for he suddenly disappeared from the deck. The monitor immediately afterward retired precipitately from the scene of action.—*London Daily News' Turna-Magurelli Correspondence.*

Iron Ship Building.

The report of the Secretary of the American Iron and Steel Association furnishes the following statistics of iron shipbuilding. Of the 25 vessels built in the fiscal year 1876, 2 vessels, aggregating 139·78 tons, were built at Buffalo; 1 vessel of 12·99 tons was built at Burlington, N. J.; 11 vessels, aggregating 11,980·94 tons, within the jurisdiction of the port of Philadelphia; 9 vessels, aggregating 8,298·08 tons, in the State of Delaware; and 2 vessels, aggregating 915·12 tons, at New Orleans. At the present time there are building or under contract on the Delaware river, 9 large iron steamships of the best class, ranging from 1,800 to 2,500 tons burden, including two monitors for the United States Government, besides a number of powerful iron tugs of 200 or 300 tons burden, and other small craft.

Cutting off Strawberry Runners.

When it is not desired to propagate young plants, strawberries should have their runners removed several times during the growing season; and where half an acre or more is cultivated, the trouble and expense are considerable. The operation is usually performed with shears, or by pinching or pulling off by hand. To save the back ache induced by the operation, we publish (Fig. 1) an engraving showing an attachment to the shears by means of which the work may be done in an upright posture. The *Rural New Yorker* gives two other devices which expedite the operation, and make it far less wearisome. In Fig. 2, B is a circular piece of iron, from seven to ten inches in diameter, one inch wide, about one quarter of an inch thick at the top and beveled to an edge at the bottom; two iron strips, P P, are welded or riveted at opposite sides, as shown, and bolted to the handle. By placing the cutting ring, B, around the hill and pressing downwards, all the runners underneath the edge are instantly severed. Should the soil be hard, or the cutting edge dull, a quick thrust with the foot upon the rest, A, will do the business. By this plan a large patch can be freed from runners in a few hours.

Fig. 1.

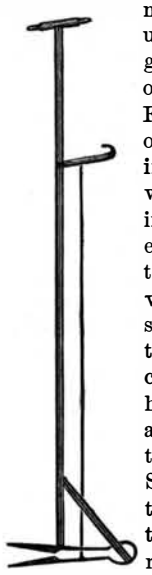


Fig. 2.

A cheaper implement is shown in Fig. 3. H is a circular and thin wheel, of iron or steel, from four to six inches in diameter, ground sharp at the edge, and attached to a stick

Fig. 3.

(an old hoe handle will answer). If inserted in a slit made with a coarse saw and held in place by a rivet, it revolves easily. Run it half round the hill in one direction, then as far in the other, and it is done; you can cut as close to a hill or as distant from it as you like. It may also be used for cutting sods in squares, preparatory to being cut loose at the bottom with a shovel.—*Weekly Globe.*

Earthquake in Tennessee.

The afternoon of July 14, a distinct shock of earthquake was heard by the residents of Memphis, Tenn. There were two heavy shocks, accompanied by a rumbling noise which once heard can never be forgotten. The "shocks," so to speak, lasted several seconds, in fact almost half a minute, during which time buildings quivered and windows rattled, as moved by the mysterious force within. In several instances the floors of the dwellings were sprung and caused no little alarm to the occupants, but no further damage was done.

Coal Area of the United States.

There are only 450 square miles of anthracite coal in the whole United States. The Reading Company owns no less than one third of the whole. Of bituminous coal land there are in America 200,000 square miles, and 8,000 square miles in Great Britain.

One of the old landmarks of Baltimore, the City Hall, on Holliday street, is soon to be torn down. It was built by Rembrant Peale in 1813, as a museum, and was a popular place of resort for nearly seventeen years, when it was purchased by the Common Council. It was the first building in the city that was lighted with gas—Mr. Peale charging a small fee in 1816 for the exhibition of carburetted hydrogen gas.

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About Nails.

Most people have to use nails of one kind or the other every now and then, yet few persons know how or where they are made, or have given any thought as to the way in which they are disposed of. As in the case with pins, nails are to be bought very cheaply, and are so abundant that one naturally inquires where they all go. Hardly any description of hardwares can boast of a more respectable antiquity than nails, inasmuch as they are mentioned in the fourth chapter of the Book of Judges in conjunction with the killing of Sisera by Jael, and in sundry otherparts of the Bible. There can be little doubt, nevertheless, that the nails of olden times were but clumsily shaped pieces of iron, which undoubtedly served the purposes for which they were used, but would be very unlike the articles bearing the same name nowadays.

Throughout the Middle Ages the only way in which nails were made was by hand, and it was not until the seventeenth century that it dawned upon one mind, at least, that it was possible to produce them by means of machinery. The first evidence of this interesting fact we find in a State paper, which records that in the year 1606 letters patent were granted by our well beloved monarch, King James, to his trusty knight Sir Bevis Bulmer, for the latter's invention of this ilk. We find it recorded that the said Sir Bevis Bulmer "hate invented a new, Apt, or Compendious forme or Kinde of Engine or Instrument to be put in vse, driven, and wrought withall by Water or Waterworkes as well for the concerning a Quicker and more Apt and Speedy Ways and Meanes then Knowne, exp'imented, and vsed within our Realmes and Domynions within the Tyme of Man's memory for, in, about the cutting of iron into small Barrs or Rodd to serve for the making of Nayles, for the necessary vse and service of vs and our subjects," and so on, with much more ingenious, but tedious, legal verbiage. Sir Bevis, however, does not appear to have been very successful with his nail rod machinery, and as time grew older other trusty subjects of various subsequent sovereigns tried to mend matters, with no very encouraging success—in fact, it was not until the beginning of the present century that machinery began to be utilized in a practical and commercial way.

In the year 1811 a Birmingham firm made the experiment of cutting nails out of sheets of iron by ingeniously contrived machinery, and by the year 1820 such improvements had been made as had placed the experiment beyond the bounds of hypothesis, and within the circle of trade routine. About the same time some American manufacturers adopted similar processes, so that the use of this kind of machinery would appear to have been almost contemporaneous in both countries. Since that time there have been hundreds of patents taken out in this and other countries for inventions and improvements in the making by machinery of the multitudinous sorts of nails; but in all, the leading principle has been the same, so that the inventions of to-day are simply more or less ingenious variations of the original idea.

Despite the great and important magnitude of the cut nail industry—all machine-made nails are called cut—at the present time, there is still a large business done in hand-made articles, and many thousands of workpeople, of both sexes, are employed in their production. The Black Country—at Dudley, Netherton, Sedgley, Gornal, Wordsley, Rowley, Cradley Heath, Lye Waste, Harborne, Birmingham, Stourbridge, West Bromwich, and other towns and villages—is the center of the wrought or hand-made trade; but it is also very extensively carried on at Sheffield, Rotherham, Grenoside, Belper, and many smaller places in Derbyshire, Worcestershire, and South Yorkshire. Prior to the general use of machinery there were something like 50,000 hands employed in the trade in Staffordshire alone, whereas at the present time the number of wrought nailers in that district does not exceed 17,000 or thereabouts.

Formerly the great London dock companies—the East India, West India, London, etc.—used to contract for nearly 200 tons of hand-made nails annually—most of them for tea chests; but now they only use an infinitesimal proportion of the same goods. In the same manner the Admiralty, 50 years ago, had nearly 700 tons of wrought nails yearly, a quantity which has dwindled away to almost nothing before the growing cheapness and quality of cut nails. Then, too, foreign competition has been a serious matter for the hand nailers, inasmuch as the American manufacturers have not only learned to supply the requirements of their own country, but now also furnish the Canadians with all the cut nails they need. On the continent of Europe the same thing has taken place, the Belgian production of machine-made nails being, roughly speaking, 30,000 to 35,000 tons yearly—a portion of which is sent to this country. The hand workers, however, have all along made a running fight against the machinery, which has, nevertheless, so surely usurped their places, and have on many occasions committed acts of such violence as have placed them beyond the pale of public sympathy. Their employers—all of whom find the iron and pay so much per 1,000 or per lb. for the nails made therefrom—reduced their wages in 1837, in 1838, and in 1842. In the last mentioned year there were very serious disturbances in the neighborhood of Dudley, but in the end the poor nailers were worsted, as they have been on many subsequent occasions. At one time the vile truck system flourished in no trade so boldly and mischievously as in this, but since 1850 the practice has to a great extent fallen into desuetude, although still in vogue in an underhand and surreptitious manner here and there. The men work at their trade in little smithies attached to their dwellings, and in many instances their wives and children also labor in the same manner. The men can earn about 10*s.* to 16*s.* weekly, women 6*s.* to 8*s.*, and children from 3*s.* to 5*s.* weekly. The work is not, as a rule, heavy, yet requires a dexterity only to be acquired by long practice and powers of endurance which the younger workers cannot possibly possess, and the want of which is necessarily most prejudicial to their wellbeing.

In one branch of nail making, however, the application of machinery has not as yet been attended with any very marked success—that is, the manufacture of horse nails. As a consequence the men that make them are better paid than the common nailers, and they are more self-assertive or independent, as is evinced by the numerous strikes that are constantly taking place. The chief seats of the horse nail making branches are near Dudley, in Staffordshire, Belper in Derbyshire, and Sheffield in Yorkshire. Altogether it employs nearly 3,000 persons—about 2,000 at Dudley, 500 at Belper, and 250 or 300 at and near Sheffield. Belper is supposed to be the most ancient seat of the industry, and claims to have ruled even Staffordshire at one time in the matter of wages and prices. Continual disputes—particularly one in 1850—drove away the trade, however, to a great extent, and it seems now to be centralized around Dudley.

Horse nail makers are paid at rates varying from 4*s.* to 4*s.* 8*d.* per 1,000, at which prices good workmen may earn 23*s.* to 30*s.* weekly, when work is abundant, as is generally the case in this branch of the industry. The men aver that horse nails will never be successfully made by machinery, and have, in consequence, pursued the suicidal policy of keeping up wages, by restricting the number of apprentices and other artificial means, which in the end must of necessity prove abortive.

The cut nail trade is very extensive nowadays, being carried on not only at Birmingham and in various parts of South Staffordshire, but in Wales and Scotland, as well as at Newcastle, Darlington, Leeds, Sheffield, and Warrington. All machine-made nails are cut from sheets, strips, or bars, and can be produced in great quantities at a very cheap rate. About 20,000 to 25,000 tons are made every year in Birmingham alone, and fully as many more in the other places just alluded to. The men who attend to the machines are paid at the rate of 30*s.* to 50*s.* weekly, women and boys 10*s.* to 17*s.* 6*d.*, and the mere laborers 20*s.* to 25*s.* per week. As may be imagined, there is an immense variety of nails, whether wrought or cut, each of which has its distinguishing name and peculiarity. Some of them are so small that 1,000 only weigh an ounce and a half, whilst the "tenpenny" sort, eight inches long, weigh a hundredweight to the same quantity. Altogether there are about 2,200 different sorts of nails and rivets—which come in the same category—made, and used for an almost infinite variety of purposes. They are made, too, not only for this country, but for use all over the world, as is evinced by the fact that we annually export something like 17,000 tons of them. Our best country is Australia—that great colony which is yearly becoming of more importance to us as a manufacturing nation—to which we send 4,000 tons annually. British India ranks next on the list with about 1,800 tons, the British West Indies next with 1,500 tons, and then British North America with 1,300 tons. Russia, too, is not a bad customer, as she takes from us 800 tons yearly, and the Foreign West Indies contribute over 600 tons toward the aggregate. Brazil is a capital buyer, her last year's purchases of this class having reached over 900 tons; Germany takes over 300 tons per annum, Holland 400 tons, France 300 tons, Spain 250 tons, British South Africa 400 tons, and other countries, or our own colonies, quantities ranging from 100 to 200 tons.

$20,000 Prize for a New Sugar Extraction Process.

The General Council of Guadaloupe offers a prize of $20,000 to the inventor of a new process of extraction of juice of sugar cane or of sugar fabrication. This prize will be given to whoever obtains from the cane a yield of 14 per cent of sugar. The cost of application of the new process should not exceed 40 per cent of the value realized. Experiments will continue four years, terminating June 30, 1880, and will take place at Guadaloupe under the auspices of a government commission. All cost of transport, etc., must be defrayed by competitors, and applications, etc., must be addressed to the Director of the Interior, Basse Terre, Guadaloupe.

The cane raised at Guadaloupe contains 18 per cent of sugar. Hitherto a percentage of 9·4 on an average has been obtained by the ordinary factory machinery. Recently M. Ducharsaing has invented an imbibition process, the details of which are not given in the legislative document before us, but which it appears increased the yield from 9·4 to 11·64 per cent. The inventor himself claims a greater advantage, and insists that the additional percentage of gain by his process is 2·33 instead of 1·64. Even on the lower estimate M. Ducharsaing's invention was deemed sufficiently important to warrant the awarding to him of a $20,000 prize. The present premium is therefore a second one, and the winner is called upon to make a still further improvement. The experiments must be conducted on at least 660,000 lbs. of cane.

The Sutro Tunnel.

A correspondent of *Engineering and Mining Journal* declares the Sutro Tunnel second to no enterprise in the West. He says: "Its mouth is in the valley of the Carson river, a stream which washes the eastern base of the Washoe range, in which the Comstock lies. It has been driven a total distance of 17,000 feet up to date, and is making progress at the rate of 300 feet per month. Not more than 2,800 feet now intervenes between the breast and the nearest mine on the Comstock, the Savage, so that, if the present rate of progression be maintained, about 10 months more will suffice to complete the connection. The lode will be cut at a depth of about 1,800 feet perpendicularly below the surface, and very nearly the center, measuring by the extent of the surface workings. It is then proposed, either by the Sutro Company or by a combination of owners along the vein, to run a drift north and south through each claim until the ends of the veins laterally are reached. This will connect every mine on the vein with the tunnel; will drain the entire workings; and, should these lateral drifts be put under one management and made a common highway, will afford the means of working the entire vein through one opening. It is now eight years since work was first begun at the town of Sutro on the Carson river. The expense of prosecuting the work has averaged about $1,000 per day, and when the Comstock is reached the total cost will have amounted to about $3,000,000. The tunnel is double-tracked, as straight as an arrow in its course, with a rise just sufficient for drainage. Three air shafts have been sunk along its course. At the mouth of the tunnel the Sutro Company have laid out a town, have secured magnificent water powers, and expect to realize largely on that part of their investment by the removal of most of the mining and milling operations on the vein from Virginia City to Carson."

The Wool Clip for 1876.

The wool clip of the United States for 1876 was about 200,000,000 lbs.; of England, Ireland, and Scotland, about 162,000,000, mostly combing; of the Continent of Europe, about 463,000,000; of Australasia, about 350,000,000; of Buenos Ayres and River La Plata, about 207,000,000 lbs. These are the principal wool-growing countries of the world, and produce 1,382,000,000 out of the estimated 1,419,000,000 produced on the entire globe. The selling value of the total clip would probably aggregate $450,000,000. Out of fourteen hundred and nineteen million pounds of wool (the estimated clip), there would be fully a loss of 567,000,000 lbs. in scouring, making the net yield of clean wool about 852,000,000 lbs.

The First English Book.

At the Caxton Exhibition in the South Kensington Museum in London may now be seen the earliest book printed in the English language, the "Recuyell of the Historyes of Troy," upon which William Caxton began his career as a printer about 1474. The copy on exhibition is particularly interesting as having once belonged to Elizabeth Woodville, Queen of Edward IV. and sister of Earl Rivers, Caxton's patron. It now belongs to the Duke of Devonshire, having been bought by the late Duke at the sale of the Roxburgh library, in 1812, for 1,010 guineas.

Effect of Smoke on Trees.

Mr. Alcock, who for twenty-five years has been making experiments with trees planted in the vicinity of his cotton mill, near Manchester, England, finds that the plant which does better than any other tree in London smoke will not grow at all in that of Lancashire; but, on the other hand, he has been very successful with the beech, sycamore, birch, wych elm, and Turkey oak, but the lime does best of all. Here is a hint for Pittsburgh and Cincinnati. There is a society in Manchester called the Field Naturalists' and Archæologists' Society, which is urging the planting of trees in and about Cottonopolis.

Horseflesh for Human Food.

In 1875 the horse butcheries of Paris furnished for public consumption 6,865 horses, asses, and mules; in 1876 they furnished 9,271, giving 1,685,470 kilogrammes of neat meat. At Lyons, the number has diminished from 1,262 in 1875 to 1,088 in 1876. On the 1st of January there were 58 butcheries in Paris and only 7 in Lyons. At its meeting, on January 9, the committee *de la Viande Cheval* awarded a silver medal to M. Petard, who has nine butcheries in Paris, as a reward for his enterprise.

A New Air Gun.

A patent has recently been granted to a well-known firearm manufacturer in Gotha, in Germany, for an improved air pistol, which is likely to be largely adopted by the German army, not for use on actual service, but as a means of instructing men in shooting. The advantages claimed for the new weapon over any pattern of air gun previously designed, are simplicity of construction and ease in manipulation. The principle, it is said, can easily be adapted to any firearms at very little cost.

Lawns.

Mow lawns sufficiently often to preserve a neat appearance, as, when the grass is allowed to get too long without cutting, instead of saving it entails more labor. During the summer months mowing machines should be set so as to leave the grass half an inch longer than earlier in the season and late in the autumn; this is especially needful where the land is dry, and the roots of the grass are liable to be burnt up.

A LINE of steamers is established between Boston and London, to sail under the Belgian flag; and two steamers of 1,800 tons each have been purchased. The first left London for Boston direct July 5th.

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The Devil Fish.

At a meeting of the Chicago Academy of Sciences, Dr. Velie made a report of his explorations along the coast of Florida, in search of natural and archæological curiosities. On this trip, he was accompanied by his brother, Mr. A. E. Velie, of Aurora, and Dr. Hammond, of Geneseo, Ill. The expedition was rich in results, and the Doctor brought home with him a very large collection of valuable specimens for the museum of the academy. His report was very brief, consisting of little more than a description of his voyage and a list of the curiosities which he had collected.

Not the least of these was a devil fish, which formed the subject of a paper by Professor Peabody, who entered minutely into its character, disposition, and habits. The body of the fish was large, the transverse exceeding the longitudinal diameter; skin rough, but without any evident tubercles or spines; head not distinct from the body, subtruncate in front, slightly convex; mouth subterminal, with very small teeth in seven or eight rows; nostrils small, and placed near the angles of the mouth; eyes prominent, lateral, and placed on eminences at the bases of the frontal appendices: bronchial apertures narrow, linear varying from one to two feet in length, with valvular covering; tail long, slender, subcompressed, terminating in a slender extremity; dorsal fin at base of tail, small and triangular. The dimensions of Dr. Velie's specimen are as follows:

Width at pectorals, 10 feet 2 inches; length, exclusive of tail, 5 feet 5 inches; length of tail, 4 feet 2 inches; thickness of body, 1 foot 6 inches; length of frontal appendices, 1 foot; width of frontal appendices, 6 inches.

The back of the male is black, while the female has a broad, angulated belt of a lighter color crossing the back immediately behind the eyes. The specimen captured by Dr. Velie is a female. It is a comparatively small fish, as those described by Elliott and De Kay were seventeen or eighteen feet in width, and others of equal dimensions have frequently been encountered, though rarely captured.

Professor Peabody related several anecdotes illustrative of the strength of the devil fish. One, eighteen feet broad, towed a thirteen ton schooner, with all sails set, in the face of a brisk wind, until the harpoon drew out and the fish escaped. Dr. Velie experienced great difficulty in making his capture. He harpooned five other fish, but lost them all. The one captured succumbed only after an hour's struggle. Among the means of assault which the fish possesses are its frontal appendices, which are movable, and with which it can seize and hold, as by power of suction, anything coming within reach. In this respect only does it resemble the devil fish known to the readers of Victor Hugo. The food of the devil fish has been supposed to be crustaceans. Some scientists are of opinion that it lives on other fish, but no scales have ever been found in its stomach. The stomach of Dr. Velie's specimen contained a large quantity of a reddish, moss-like substance, which Professor Reinsch of Bavaria, one of the members of the Chicago Academy, identified as seaweed, possibly a new species.—*Chicago Tribune.*

Recent American and Foreign Patents.

Notice to Patentees.

Inventors who are desirous of disposing of their patents would find it greatly to their advantage to have them illustrated in the SCIENTIFIC AMERICAN. We are prepared to get up first-class WOOD ENGRAVINGS of inventions of merit, and publish them in the SCIENTIFIC AMERICAN on very reasonable terms.

We shall be pleased to make estimates as to cost of engravings on receipt of photographs, sketches, or copies of patents. After publication, the cuts become the property of the person ordering them, and will be found of value for circulars and for publication in other papers.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED LINK-MOTION FOR STEAM ENGINES.

Frederick Fischer, New York city.—This invention is to provide for locomotive and other engines an improved link-motion, by which the travel of the slide valve may be modified in such a manner as to move at greater speed when closing and opening the ports, so that the steam engine may be worked more effectively for expansion by retaining the steam longer, and also facilitating the entrance and exhaust of the same.

IMPROVED TIRE HEATER.

William E. Stewart, Xenia, O.—This invention consists in a tire heater formed by the combination of a hollow base, a semi-ring trough provided with holes, and a cap, made in sections, hinged to each other, and having flanges formed upon their side edges.

IMPROVED COILED SPRING.

James Ludlum, Pompton, N. J.—This invention consists in the peculiar construction of the ends, whereby an improved bearing is secured and the spring is made stronger and more durable.

IMPROVED GRINDING MACHINE.

Louis Bollmann, Vienna, Austria.—This is an improved machine for grinding by means of emery wheels, and feeding the work by an elastic yielding pressure to the emery wheel, controlling the grinding process, and preventing any danger that may arise from the bursting of the wheel. A reciprocating slide rest feeds the work with yielding pressure, and allows the grinding action of the emery wheel during the forward motion only of the slide rest. The slide rest and its operating mechanism are laterally movable for adjustment in the main frame. A hood mounted on an elastic support over the emery wheel guards against danger from bursting.

IMPROVED ATMOSPHERIC GAS ENGINE.

Joseph Wertheim, Bornheim, Frankfort-on-the-Main, Germany. The principle of this motor is the alternate action of the explosive force of a gas and air mixture and of the pressure of the atmosphere as motive powers. The arrangement consists in the explosion dome, with its main slide valve, igniting apparatus, and appendages for regulating the speed of the engine and admitting the escape of the gases of combustion, of the siphon pipe for the liquid piston, with a paddle chamber and valves at the lower part, in connection with mechanism for transmitting motion, and of a liquid reservoir.

IMPROVED TOOL HANDLE.

Lazare Landeker, San Luis Obispo, Cal.—The end of the handle is tightened in the eye of the head by wedges. A small metallic bar, the edges of which are beveled off, fits into a dovetailed groove formed across the forward slide of the head and across the end of the handle. The bar is made of such a length that its ends may be flush with the sides of the head, and of such a thickness that its outer surface may be flush with the forward side of said head. Through the center of the bar is formed a hole to receive a screw, which is screwed into the end of the handle, and the head of which is countersunk into the bar.

IMPROVED DUMPING CAR.

Henry S. Bower, Mulberry Grove, Kan.—This invention relates to an improved dumping car for the more rapid discharging of grain, gravel, and other articles shipped in bulk. It consists of a car body hinged to center posts of the truck frames, so as to swing to either side of the truck, the body being supported by hinged and braced posts at both sides of the center uprights, which posts are swung down at the proper side when dumping. Swinging rack irons at the bottom of the car body lock into a slotted plate to retain the car in dumped position. The side boards of the car are hinged and locked in suitable manner.

IMPROVED HORSE POWER.

Darius K. Hungerford, De Witt, Iowa.—This consists mainly in a double tread power, constructed with the treadles arranged in planes inclining in opposite directions, and geared to a single driving shaft. The device also consists in means applied to the outer or free ends of the treadle frames for giving them any desired degree of inclination, whether the horses be working or at rest.

IMPROVED CAR COUPLING.

Charles D. Norman, Ames, Iowa.—This invention is an improvement in the class of car couplings in which the drawhead is provided with spring jaws, hinged near the front thereof, and inclining inward or toward each other at their rear ends, whereby they are adapted to engage with an arrowhead drawbar. The object of the invention is to simplify and cheapen the construction of this class of coupling and increase their efficiency and value. For details, see patent.

IMPROVED WATER WHEEL.

James J. Bourgeois, St. Cloud, Minn.—The present invention relates to an improvement upon that for which the same party has received letters patent of the United States, No. 171,088, dated December 14th, 1875. In the former invention horizontally sliding gates are arranged over the wheel to regulate and cut off the flow of water to the wheel. When there is a full head of water, the vertical pressure on the gates causes so much friction that it is difficult to operate them. To avoid this result the inventor has devised a hinged gate, and arranged it beneath the wheel. For details, see patent.

IMPROVED STATION INDICATOR.

James W. Graydon, Indianapolis, Ind.—The names of the cross streets or stations (as the case may be) are printed on a transparent apron which is moved intermittently to expose the names successively to view. The means for operating the apron are primarily a chain wheel and pulley, the former being provided with radial arms, with which an intermittently reciprocating pusher comes in contact at the required time, for turning the chain wheel one quarter of a revolution. The said pusher works vertically in suitable guides, and is operated by contact of a shoe, upon which it rests, with an inclined plane attached to the sleepers between or alongside track rails.

NEW MISCELLANEOUS INVENTIONS.

IMPROVED PICTURE FRAME.

Edward Maux, New York city.—This invention consists of a passe-partout with a backing having a suitable opening for the pictures, and being placed back of face lining of the covering glass.

IMPROVED PAINT PENCIL OR CRAYON.

William J. Holton and James E. Field, Milwaukee, Wis.—The paint is thoroughly intermixed in a body of tallow while warm. A resinous matter is also mixed in. The whole is moulded or pressed into pencils of such a size and shape as may be desired. This paint pencil is not affected by water, and cannot be rubbed off a surface when applied without great difficulty; and furthermore, it marks on a polished surface with equal ease to that of a rough surface, thus forming a substitute for the marking pots and brushes now commonly in use.

IMPROVED APPARATUS FOR ILLUMINATING SCALE BEAMS.

Joshua W. Wood, Loami, Ill.—This consists in the combination of an illuminating device with the sliding loop to which the weight is attached, and also in the combination of reflectors with the loop and with the beam, for the purpose of throwing light upon the side of the scale beam, which would otherwise be dark.

IMPROVED ROLLER RAZOR SHARPENER.

Welmer T. Jahne and Charles H. White, Jersey City, N. J.—Two wooden rollers are covered with leather, and have emery flour applied to them. They are held together to bear against the sides of the blade by U springs. By suitable gearing the said rollers are caused to revolve together and in opposite directions to grind both sides of the blade equally.

IMPROVED INKING APPARATUS.

John G. Kurtz, Milton, Pa.—This invention consists of a fountain for printing ink having a tightly fitting piston fed forward by a screw rod, so as to force the ink through a bottom feeding cloth or screen, the same being placed, after use, into an airtight seat plate holding water to keep the feeding cloth moist.

IMPROVED COMBINED SNAP HOOK AND BUCKLE.

Francis J. Deisz, Pierce City, Mo.—This combined snaphook and buckle is for connecting the ends of the breast strap with the hame ring. It is so constructed as to clamp the strap, and thus take the strain off the tongue of the buckle.

IMPROVED INDEXING.

David A. Roberts, Columbus, O.—The book has one slit in each leaf, each succeeding slit being cut a little lower down than the preceding one. A blade is placed upon the first page of the set, and is moved downward, passing through the notches until it is opposite the name of the party whose account is looked for and the number of the page upon which that account is kept, and the blade is then raised, opening the book.

IMPROVED OIL CAN.

Jacob F. Cappel, Havana, Ill.—This improvement consists in the particular construction and arrangement of a pump with two pipes and two valves or cocks, whereby the one pump which is located upon the tank may, by reversing the valves, be equally as well employed for transferring from the barrels as for dispensing from the can.

IMPROVED HOG ELEVATOR.

George Wheeler, Newark, O.—This invention consists mainly of uprights or standards detachably and adjustably connected to a base, and having adjustable horizontal bars for supporting the carcass, and a windlass for hoisting it. The invention further consists in so constructing the base of the hoisting apparatus that a platform may be detachably connected therewith.

IMPROVED BOX FASTENER.

Jerome C. Millard, Pultneyville, N. Y.—This device is applicable to various uses, but is intended particularly as a fastening for physicians' hand medicine cases or boxes. It consists of a catch of irregular shape having a projection that engages a notched stud projecting from another plate, the said plates being respectively designed and adapted for attachment to the body and cover of the case or box.

IMPROVED SAFETY STIRRUP.

William B. Conway, Blacksburg, Va.—This invention is an improved safety stirrup designed to prevent the rider from being dragged by the foot if in being thrown from the horse he should get his foot caught in the stirrup. The improvement consists in pivoting, in the sides of the stirrup just above the space for the foot, a protector or guard which is extended above its pivots around the connecting bar at the top of the stirrup in the form of a hooked plate, which passes between the connecting bar and the two higher metallic rods so as to secure the stirrup to the stirrup strap by a metallic loop entered between the two upper bars and caught by the hooked plate of the pivoted guard. Should the rider fall, the toe deflects the guard and allows the stirrup to drop with the rider.

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED FIRE ESCAPE.

Richard J. Macdonald, New York city.—This invention consists of a hollow cornice or cap above the top of the window casing, which is provided with a bottom aperture closed by a movable seat, that is raised or lowered by a drum and suspension cord, in connection with a lowering cord and drum and an endless tension cord and pulleys for hoisting or lowering the seat.

IMPROVED LAMP SHADE HOLDER.

Partrick J. Clark and Joseph Kintz, West Meriden, Conn.—This lamp shade holder is so constructed that the shade may be turned back to allow the lamp or lamp chimney to be detached, and enables the shade to be conveniently detached from the holder when desired.

IMPROVED ELLIPTIC SPRING.

Noah J. Tilghman, Tyaskin, Md.—This invention belongs to that class of springs in which the plates are made of a single continuous piece of metal bent around in elliptical form without end joints and placed one within the other. The improvement consists in bringing the ends of the plates together, so that the free ends of each abut, and in riveting said free ends to a lap joint plate which performs the double function of connecting the ends of the plate and of separating and removing anyone spring of the series from the next adjacent ones, so that such springs do not touch each other at this point, and whereby each spring is rendered capable of free, easy, and independent movement without impinging against the others, which to a great extent obviates creaking.

NEW AGRICULTURAL INVENTIONS.

IMPROVED COMBINED POTATO AND CORN PLANTER.

Joseph Custer, Goshen, O.—This improved seed planter is so constructed that it may be readily adjusted for planting potatoes or corn. To the side of the seed box are attached the ends of the curved guard plate, which incloses the space around the discharge hole through the bottom of said box, and beneath the lower edge of which the dropping plate passes, so that no more seed can be carried out by said dropping plate than is contained in its holes. To the forward part of the guard is attached a knife, which, when planting potatoes, will cut off any parts of potatoes that may protect above the plate to enable the rest of the potato to be carried within the guard and dropped to the ground. The guard and knife are adjustable, so that they may be adjusted according to the thickness of the dropping plate.

IMPROVED GATE.

Eli Wayland, Salisbury, Mo.—This gate is so constructed that its forward end may be raised and so supported that the gate may be swung open and shut, and may thus swing over snow and ice, and allow small stock to pass beneath it, while preventing the passage of large stock, and which will be simple in construction, strong, and durable.

IMPROVED POST DRIVER.

William Kindermann, Troutville, Pa.—This invention is for the purpose of driving fence posts, etc., and is an improved, powerful yet simple driving machine, that may be readily adapted to any inclination of the ground, and used with horse power to drive the posts in rapid and effective manner.

NEW HOUSEHOLD INVENTIONS.

IMPROVED LAMP REFRACTOR.

August Schaeffer and Anton Pfrunder, Louisville, Ky.—This invention consists of the combination, with a gas or other lamp, of one or more hinged and adjustable refractors, having pivoted and self-adjusting shades. The refractors are hinged and clamped to a detachable collar, attached to the neck of the lamp or base of the burner.

IMPROVED LAMP CHIMNEY FASTENING.

George Richards, Flatbush, N. Y.—This invention consists in the inwardly projecting notched flange formed around the lower edge of a lamp chimney to receive springs attached to the top plate of the burner; and in the springs attached to the top plate of the lamp burner, and having outwardly projecting lugs formed upon their ends to overlap an inwardly projecting flange of a lamp chimney.

IMPROVED LAMP BURNER.

James Cain, Pittsburg, Pa.—This is a new lamp burner, into which a new wick is inserted with great facility, and which is easily kept clean of gum and burnt wick, the ratchets being also readily reached and kept in order. The burner is split diametrically and lengthwise through the wick tube into two sections, which are hinged and locked together, and have fixed or removable ratchets.

IMPROVED PLAITING MACHINE.

John E. Chapin, New York city.—This consists of a plaiting board with hinged plates and plaiting needles pivoted at one end to the same. A detachable side strip of the plaiting board, with catches or hooks, locks the needles, and releases them simultaneously on being taken off. The tension of the fabric to be plaited is regulated by a tension rod at one end.

IMPROVED FOLDING TOILET SCREEN.

Edward S. Lathrop, Savannah, Ga.—The object of this invention is to provide for use in sleeping apartments an improved screen for protecting the person from observation while bathing, dressing, or performing other operations of the toilet. The frame of the screen is attached to the toilet or washstand, and is made adjustable in order that the curtains pendent therefrom may be extended when required, and at other times drawn back or folded against the wall so as to be out of the way and form an ornamental article of furniture.

IMPROVED BURGLAR ALARM.

James K. Johnston, St. Louis, Mo.—The fastener consists of a toothed plate having a hinged extension to which a bell alarm and sliding trigger are attached in such manner that the latter will trip the alarm in case the door is forced open. The advantages of the device are compactness, portability, simplicity, and cheapness of construction, and the facility with which it can be applied to and removed from a door.

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For Sale—New Steam Launch, 30 x 8 feet; "fast;" Black walnut and Nickel finish; $1,200; also Side Wheel Steamer, 50 x 16 feet, $3,000. S. E. Harthan, Worcester, Mass., Manuf. of Engines and Launches.

An American, experienced in the manufacture and refining of Beet Root Sugar, speaking German, French, and some Spanish, seeks employment. Good testimonials. Address P. O. Box 4182, New York city.

What have you in the kitchen, furnishing, or hard ware line you want made on royalty for the Western trade. W. C. Seavey & Co., Chicago, Ill.

For Sale—Foundry and Agricultural Works, cheap, as I wish to move to my farm. Address Box 189, Sodus, N.Y.

See our Advertisement. Parties writing please state what kind of machinery is wanted. Steptoe, McFarlan & Co., Cincinnati, O.

Good Second-hand Steam Engine, cylinder 12 x 24 in.; flue boiler 40 in. x 25 ft.; smoke stack and connections complete; for sale cheap. C. S. Green, Roaring Branch, Lycoming Co., Pa.

600 New and Second-hand Portable and Stationary Engines and Boilers, Saw Mills, Woodworking Machines, Grist Mills, Lathes, Planers, Machine Tools, Yachts and Yacht Engines, Water Wheels, Steam Pumps, etc., etc., fully described in our No. 12 list, with prices annexed. Send stamp for copy, stating fully just what is wanted. Forsaith & Co., Machine dealers Manchester, N. J.

Reliable Oak Leather and Rubber Belting. A specialty of Belting for high speed and hard work. Charles W. Arny, Manufacturer, Phila., Pa. Send for price lists.

Shaw's Noise-Quieting Nozzles for Escape Pipes of Locomotives, Steamboats, etc. Quiets all the noise of high pressure escaping steam without any detriment whatever. T. Shaw, 915 Ridge Ave., Philadelphia, Pa.

For Solid Wrought Iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

"Abbe" Bolt, Forging Machines, and "Palmer" Power Hammers; best produced. Prices greatly reduced. Also sole builders Village and Town Combined Hand Fire Engines and Hose Carriages, $350. Send for circulars. Forsaith & Co., Manchester, N. H.

John T. Noye & Son, Buffalo, N. Y., are Manufacturers of Burr Mill Stones and Flour Mill Machinery of all kinds, and dealers in Dufour & Co.'s Bolting Cloth. Send for large illustrated catalogue.

Removal.—Fitch & Meserole, Manufacturers of Electrical Apparatus, and Bradley's Patent Naked Wire Helices, have removed to 40 Cortlandt St., N. Y. Experimental work.

Power & Foot Presses, Ferracute Co., Bridgeton, N. J.

For Best Presses, Dies, and Fruit Can Tools, Bliss & Williams, cor. of Plymouth and Jay Sts., Brooklyn, N.Y.

Lead Pipe, Sheet Lead, Bar Lead, and Gas Pipe. Send for prices. Bailey, Farrell & Co., Pittsburgh, Pa.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing metals. E. Lyon & Co., 470 Grand St., N. Y.

Solid Emery Vulcanite Wheels—The Solid Original Emery Wheel—other kinds imitations and inferior. Caution.—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 38 Park Row, N. Y.

Steel Castings from one lb. to five thousand lbs. Invaluable for strength and durability. Circulars free. Pittsburgh Steel Casting Co., Pittsburgh, Pa.

Help for the weak, nervous, and debilitated. Chronic and painful diseases cured without medicine. Pulvermacher's Electric Belts are the desideratum. Book, with full particulars, mailed free. Address Pulvermacher Galvanic Co., 292 Vine St., Cincinnati, Ohio.

Split-Pulleys and Split-Collars of same price, strength and appearance as Whole-Pulleys and Whole-Collars. Yocum & Son, Drinker st., below 147 North Second st., Philadelphia, Pa.

Small Fine Gray Iron Castings a specialty. Soft and true to patterns. A. Winterburn, 16 De Witt St., Albany, N. Y.

Skinner Portable Engine Improved, 2 1-2 to 10 H. P. Skinner & Wood, Erie, Pa.

Wanted—A first-class Machine forger. One who is a good performer on any instrument in Brass Band. References required. Address H. B. Smith, Smithville, Burl. Co., N. J.

All nervous, exhausting, and painful diseases speedily yield to the curative influences of Pulvermacher's Electric Belts and Bands They are safe and effective. Book, with full particulars, mailed free. Address Pulvermacher Galvanic Co., 292 Vine St., Cincinnati, Ohio.

Diamond Planers. J. Dickinson, 64 Nassau St., N. Y.

More than twelve thousand crank shafts made by Chester Steel Castings Co. now running; 8 years' constant use prove them stronger and more durable than wrought iron. See advertisement, page 78.

Emery Grinders, Emery Wheels, Best and Cheapest, Hardened surfaces planed or turned to order. Awarded Medal and Diploma by Centennial Commission. Address American Twist Drill Co., Woonsocket, R. I.

Reliable information given on all subjects relating to Mechanics, Hydraulics, Pneumatics, Steam Engines, and Boilers, by A. F. Nagle, M.E., Providence. R. I.

Notes & Queries

C. H. W. is informed that we cannot find the address he mentions.—Will A. D. T. in "Minerals" of June 16, send his address to C. H. Wise, Boston, Mass?—A. K. Q.—Your question is too indefinite. We do not understand what you wish to know.—A correspondent writes a card from Primrose, Wis., but the ink is so pale we cannot read it. Will he write again?—J. W. is informed that we know of no method of using mercury as a lifting power. He must ascertain by experimenting.—J. T. G. is informed that there is no rule applicable to setting idler pulleys. His judgment must dictate the place to put them.—J. H., of Canada.—We cannot turn to the item you refer to. The recipe has been tried and was not satisfactory. You had better apply to a chemist, who can give some good recipes.—C. D.—We could not republish the diagram. If you cannot find the number containing it, it is probably one of the missing ones which we can perhaps supply.—A. M. S.—If you will give us the number and year of the paper containing the article we can probably send it to you.—E. C. H. is informed that the method of balancing cylinders of threshing machines which he mentions is the one in general use, and is, perhaps, the best that could be employed.—T. F. R. asks for a depilatory, and is referred to Cooley's "Cyclopedia of Practical Receipts," under the head of "Depilatory."

(1) G. R. asks: What sized boiler do I need for a small engine, 1½ inch bore and 3 inches stroke? Would it run a circular saw 7 inches in diameter to saw 1 inch pine? A. To do this work you will need a boiler with from 18 to 20 square feet of heating surface.

(2) S. E. says: Please give a rule for calculating the capacity of smoke stacks, which are found in practice to give the best results? A. A good proportion for the chimney is to have its cross section about ⅛ of the grate surface, and its height from 40 to 50 feet. Some chimneys having a cross section of only ⅓ the grate surface give good results when the boiler is carefully set, but the first figure is safer for general practice.

(3) G. W. K. asks: 1. Is there a way to determine the amount or power a motor will furnish by means of a friction lever brake, having the number of feet the pulley will run and the number of lbs. pressure on friction bearing, the pulley to be smoothly turned? A. Multiply the unbalanced weight in lbs. by the circumference in feet that the point of attachment would describe if free, and by the number of revolutions of the motor per minute. Divide the product by 33,000. 2. I have a water wheel running on cast step with cast toe. It wears well; is there unnecessary friction? A. We think not. 2. What speed should a 30 inch top runner burr have under 15 horse power for grinding corn? A. About 400 revolutions a minute.

(4) P. W. N. asks: 1. How much more water will run through a gateway in a dam 10 feet wide and 30 feet high than will run through one 10 feet high and 30 feet wide. A. About 3 7/10 times as much in the first case. 2. Also the weight of 1 cubic foot of water? A. See p. 184, vol. 32.

(5) S. B. says: Some of the users of steam engines in this city (Portland, Me.) practice putting salt water in small quantities into the boilers to form a scale to prevent the action of Sebago water on the iron, claiming that the water, being very soft, has too much action on it. Is it a good practice? A. If the feed water is pure, we think the action is questionable.

(6) W. E. M. asks: If I confine steam in a hemisphere, will its force be centrifugal or centripetal? Can there be a motor made on this principle? A. The steam will press outward.

(7) B. F. T. says: What is the effective actual horse power (not therefore nominal) of a non-condensing engine 14 inches cylinder, 24 inches stroke, 100 revolutions per minute, 70 lbs. steam? I am endeavoring to obtain some simple formula by which correct results may be obtained, and that can be explained to persons not educated machinists or engineers, in connection with our business in furnishing water for horse power. The formula furnished by the SCIENTIFIC AMERICAN ought to be considered standard and satisfactory. A. The effective horse power of a particular engine cannot be exactly determined by a general rule, but must be found by experiment. It would be impossible to give an approximate rule of any value for the data sent. Such a rule that would answer tolerably well for one class of engines might be useless for another.

(8) C. D. H. says: A customer wishes me to siphon the water from a well 50 feet deep, having 30 feet of water in it. I have a fall 150 feet. I tell him I can only lessen the depth of water about 12 feet, when the siphon will cease to work. He claims it will empty the well. Which is right? A. You have the right idea.

(9) J. G. asks: Which will make the louder report, a gun with a perfectly straight bore, or one that widens a little toward the muzzle? A. Some of the patriots who have recently celebrated the anniversary of the nation's birthday will doubtless be glad to throw some light on the subject.

(10) C. D. O. says: The engine I am running has slipped its eccentric. The owner in setting it placed it so that it is a little back of the quarter stroke. I claim that it ought to be set a little ahead of the quarter. Which is right? A. We imagine that your view of the case is the more correct of the two.

(11) W. K. asks: 1. Whether a boat 30 feet long and 6 feet beam, run by steam, just for sporting purposes, would require a government test and license? A. It does, according to the law. 2. How large a wheel does it require for two engines with 2½ inch by 4¼ inch stroke? A. Diameter 26 to 28 inches, pitch 3 feet.

(12) J. A. R. asks: Can a person see light or the object through the aid of light? A. Light, according to Watts, "is the agent which makes us acquainted with the existence of bodies through the organ of sight."

(13) J. B. T. asks: If two bodies, one weighing 1 lb. the other weighing 10 lbs., both being equal in bulk, if let fall from the same height, will strike the ground at the same time? A. Yes.

(14) I. P. F. says: To F. G. W.'s inquiry you say do not put flues in your boiler as small as 1 inch. I have just completed a boiler with nine 1 inch flues, heads of cast iron, 1 inch thick and 10 inches diameter, 30 inches long, to be set on a stove, and we can get no draught. I have made them of the same dimensions with one 4 inch flue, and they work well. A. We would be glad to hear from our readers who have been using boilers with flues of this size. So far as our experience goes, they generally give satisfactory results.

(15) O. C. writes: I wish to construct a vertical boiler and engine attached to back to develop 1 horse power at a pressure of 50 or 65 lbs. Please give me dimensions of cylinder and boiler, and if I use steel for boiler shell what thickness? If I put in tubes, how many and what diameter? A. Cylinder 2 x 3, boiler 20 inches diameter, 3 feet hight. Steel shells ⅛ of an inch thick. Tubes 1½ or 2 inches in diameter. 2. Do you think it practicable to drive a carriage on a good road by steam engine and boiler located on the same and carrying its own coal and water, to travel a distance say of ten miles? A. Yes, if properly constructed.

(16) A. D. S. says: In making experiments with small vessels to try the resistance they suffer in passing through or over water, how much should be the allowance for adherence or friction? A. We think you will find full particulars in Mr. Froude's papers, published in the *Transactions of the Naval Architects.*

(17) W. D. M. O. says: Can you tell me the best work on air, and all its properties, such as motion, resistance, use as a motive power by compression, and similar mechanical uses? Also a work on the generation of gas for power purposes, and compounds which are used to produce gas by contact in a reservoir, and the best work on ballooning? A. Rankine's "Treatise on the Steam Engine" contains a summary of the laws relating to air and various gases. You will find numerous examples of the application of these principles in the files of technical periodicals. There is an aeronautical society in England, and we imagine their transactions contain the kind of information you desire. There are also numerous valuable papers in our back numbers.

(18) W. E. S. asks: Is the fulcrum point on a vessel's mast below or above deck when she heels or inclines by the pressure of wind while sailing? The object vessel is 65 feet on the water line, 20 feet breadth of beam, about 48 tons new burden, 10 feet draught, and ballasted with 27 tons of iron and lead, with about 55 feet hoist of sails. A. It is a good question for young philosophers to answer.

(19) F. E. asks: Is there any difference in the power required to operate stamps, with short armed or long armed cams, provided the stamps have the same lift and fall in distance, are of the same weight and have the same number of drops per minute? A. There should be no difference, if the resistance due to friction is the same in each case.

(20) C. E. L. asks: Can you give me a rule to cut paper for a tissue paper balloon 10 feet high, so that when paper is pasted together the balloon will be in good proportion? Also what size should the ring at bottom be? A. You will find directions in Blinn's "Tin, Sheet Iron, and Copper Plate Worker."

(21) G. P. H. asks: 1. If I build a boat 16 feet long and of 4 feet beam, of good model, how much power, and what size of a screw propeller must I put in to realize 8 miles per hour in low water against the current in the Ohio river? A. Cylinder 3 x 4, propeller 22 inches diameter, 3 feet pitch. 2. Is a boat of the above dimensions, drawing, when well ballasted, 2 feet, capable of crossing the Gulf from New Orleans to Cedar Keys? A. At certain seasons of the year, when the weather is generally calm, such a voyage might be made.

(22) J. R. G. says: I have got an aquarium with a cast iron bottom; what can I put on it that will keep it from rusting and not injure the fish? A. Dry the iron thoroughly and give it a good coating of melted paraffin. A layer of fine white sand may be sprinkled over this as it cools.

(23) R. G. asks: How can I make a strong extract of tonka bean? A. Take 1 lb. of the beans, reduce to a coarse powder, and percolate with alcohol to make 1 gallon.

(24) W. C. L. says: I desire a liquid preparation to close the pores of eggs to preserve them. It should be cheap, dry rapidly, and not color the shell. A. Thin gum arabic solution is commonly used for this purpose. Eggs are often packed in charcoal. A good method is to store the eggs in water containing about 50 grains of salicylic acid to the gallon. The Germans use linseed oil, which seems to answer the purpose admirably. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 65, p. 1030.

(25) W. B. says: A doctor asked a chemist what iron was composed of. The chemist said that iron was an element, and could not be divided. And the doctor thought it must be composed of something. Which is right? A. The chemist was right; iron is an elementary substance.

(26) W. E. T. asks: Where are open hearth steel works located? A. Open hearth furnaces are in operation at Boston, Mass., Providence, R. I., Nashua, N. H., Trenton, N. J., Beaver Falls, Pittsburgh, Nicetown, Philadelphia, and Harrisburgh, Pa., Cleveland and Canton, Ohio, Springfield, Ill., and Hartford, Conn.

(27) W. B. asks: Can you give the recipe for making the Etruscan color in gold? A. Alum and fine table salt each 1 oz., powdered saltpeter 2 ozs., hot rain water sufficient to make solution. Add sufficient muriatic acid to produce the color desired. The solution is best used warm. After coloring wash in soft water, then in alcohol, and dry in clean sawdust.

(28) J. G. L. asks: 1. How many vibrations per second are required to produce the musical tone known as middle C? A. 264.

Can I make a fine finish on wood by rubbing on boiled linseed oil repeatedly, allowing each coat to dry thoroughly? A. Not what is termed a fine finish.

(29) C. E. D. asks: I would like to know how to get rid of a small red mite on canaries? A. Try any of the insect powders found in the market.

(30) M. A. B. asks: Does your SCIENCE RECORD contain "Practical Mechanism," by J. R.? A. No. It is published in book form under the title of "Complete Practical Machinist."

(31) E. C. H. asks: How can I melt cast iron in quantities ranging from 10 to 15 lbs.? A. In a small furnace having a good blast.

Is there such a thing as a demijohn cupola, and how is it constructed? A. We never heard of it.

On my lathe, driving wheel is 30 inches diameter, and pulley 3¾, making 8 to 1. I wished to use another speed of 4 to 1, with same belt, and calculated size of pulleys the following way, made the sum of one half the circumference of pulleys (pulley and driver) in each set the same, but it did not work at all. Will you please inform me how I can get the size correctly? A. You will and rules for calculating cone pulleys in "Wrinkles and Recipes."

(32) L. E. M. asks: Will you give me a practical rule for finding gearing for compound geared lathes? A. You will find the information in No. 7, vol. 34, p. 107, that we think will be what you require.

(33) G. P. asks: Will a spring of the following dimensions, 4 inches long, ⅞ inch diameter, and ¼ inch pitch, made out of ⅛ inch steel wire, enclosed in a chamber subject to 70 lbs. of steam to the square inch, keep its rigidity under a bolt screwed at 25 lbs.? A. Yes. 2. Will the steam affect its rigidity? A. No; but if it comes in contact with steam in moisture it could be nickel plated.

(34) E. H. M. asks: Will you give a plain rule or reference to some book plainer than Haswell, to ascertain the pitch of teeth in pattern making? A. The information you desire will be shortly published in "Practical Mechanism."

(35) A. W. asks: Is it advisable to grease cog gearing, and the reason why? A. It is best to grease cog gearing in cases in which the wheels can be kept from becoming clogged with dirt, etc.

(36) M. M. M. asks: 1. What is a suitable metal or composition for making castings for an oscillating engine 2 x 4 inches, the castings to be made in a smith fire? The blacksmiths tell me that I cannot cast iron as it will "burn." A. Make your castings of a mixture of 6 parts copper and 1 part tin. Or use old composition metal such as bell metal, and add one tenth its quantity of tin after the mass is melted. 2. How large should the steam and exhaust ports be? A. Make the steam ports 1/10 the area of the cylinder, and the exhaust ⅓. 3. Would plaster of Paris be suitable to cast in? A. Cast in a sand mould faced with plumbago. 4. How could I burnish the castings after I had them made? A. Polish with file, scraper, and emery paper.

(37) R. d'H. says, in answer to query (7) July 21, as to the time when the first movable steam fire engine was used? I know of a very powerful one to have been in use in Berlin, Prussia, as early as 1838, may be earlier. Its great defect was that it took hours before it was ready for service, so that it was jokingly remarked notice of the occurrence of a fire should be given some hours ahead. When finally at work it could throw a number of streams, it was said seven, and by concentrating its full force upon one stream, threw down stout walls. It was contemplated to be sent, if not actually done, to the large Hamburg conflagration in May, 1841.

(38) C. M. B. says: A very cheap and serviceable door spring can be made as follows: Take an old hoop skirt and place it in the fire, keeping it there just long enough to burn the cloth off the wires; remove from the fire and plunge it into cold water. Press and bend the springs together so as to form a bundle or rod a foot or more in length. Secure one end of the bundle to the door frame, twist it very tight, and, keeping it twisted, fasten the other end to the door above the end fastened to the frame, and the door spring is complete. By twisting the springs one way, they will keep the door shut; and by twisting them the other way, they will keep it open.

(39) W. F. W. says: I wish to build a dry house 50 x 50 feet square, to be divided into four rooms. I have a steam boiler 44 inches in diameter, 13 feet long, that I wish to use as a heater. What is the cheapest and best way to construct the heating part? I wish to use the house for drying green ash, and want to get heat up to 190° to 220°. A. See SCIENTIFIC AMERICAN, p. 123 vol. 34, February 19, 1876, paragraphs (30) and (43): also p. 107, vol. 36, paragraph (1); also, p. 123, vol. 36, February 24, 1877, paragraph (6).

(40) G. W. W. asks: Why is it that sap of sugar maple at the right season, boiled down, produces dry, brittle, grain sugar; but as soon as the weather gets warmer so as to swell the buds, the product is wax, that is, it will not grain. A. This is due to the presence of a free acid in the juice. Stir in a little solution of carbonate of soda, boil down, run into a wooden tub with a bung in the bottom, and, when solidified, remove the bung and let drain.

(41) G. H. E. asks: 1. What is the most sensitive and accurate test of the presence of fusel oil in liquors distilled from various grains? A. Evaporate the alcohol down to a small bulk over a water bath, add an equal volume of ether, agitate for a few minutes, and then add an equal volume of water. The ether will dissolve any amylic alcohol (the basis of fusel oil), and the ethereal solution separate into a layer distinct from the diluted spirit. This solution should be drawn off with a pipette into a small dish, and allowed to evaporate in the air. To a portion of the residue in the dish add a few fragments of iodide of potassium, and gently agitate. In the course of a few minutes, if the original spirit contained any fusel oil, a distinct yellow color will appear. This color is distinctly visible in a solution containing 0·2 per cent of the oil. The reaction is due to the volatile acids of the oil, and not to the amylic alcohol. Mix another portion of the residue with 1½ parts of concentrated (pure) sulphuric acid; a red viscid liquid (amyl-sulphuric acid) indicates amylic alcohol. When digested with sulphuric acid and acetic acid or an acetate, fusel oil yields acetate of amyl, having the odor of pear oil. Fusel oil has a strong characteristic odor, and an expert can readily detect very small quantities of it in spirits by evaporating a small quantity of the spirit on the palm of the hand, when the less volatile oil remains after the alcohol has evaporated, and is recognized by the sense of smell. 2. What is the present plan in distilleries, employed to get rid of fusel oil? A. Retainers, made of wire gauze filled with coarsely powdered charcoal, are fitted in the helm of the still so that the distillates pass directly through them; the charcoal retains the oil.

(42) S. N. B. & Co. say: We desire to pipe steam from our boliers to dry houses that are 200 feet

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away, and then return the condensation back to boilers, both feed and return pipes to be carried underground. What fall will be necessary to return the water? Also, will it be necessary to have the feed and return pipes laid with expansion joints, and what is the best material to cover with? A. Very little fall is necessary to the pipes to return the water of condensation to the boiler. A few inches will be sufficient in the distance you mention. The inclination of the pipes of the coil in the dry house ought to be about half an inch in ten feet. The pipes do not need to be connected with expansion joints. Some persons declare they are more plague than profit. If necessary, provide for expansion and contraction by a U bend. The material used for covering pipes is generally calcined plaster of Paris, and often mixed with asbestos. To use the plaster, mix with water and apply before it hardens. As it is liable to crack and peel off, it would be well to cover it with some kind of box or jacket- A method is in use here in New York city which is to encase the steam pipe in a larger pipe, made of sheet iron or cast iron; the steam pipe is supported centrally in the large pipe by means of disks of wood through which it passes. These disks can be sawed from long pieces after they are bored. Slip these disks on the steam pipe as it is being connected, and then encase in the outer pipe. It will be necessary to have the outer pipe airtight.

(43) L. S. D. says: I am about getting up a design for a poorhouse, and desire to heat it with steam or water and steam. How large an apparatus do I want to heat a building 40 x 75, two stories high, and cnt up in suitable rooms? A. See SCIENTIFIC AMERICAN p. 123, vol. 34, of February 19, 1876, paragraph (32); also, p. 74, vol. 34, January 29, 1876, paragraph (13); also, p. 123, vol. 36, February 24, 1877, paragraph (7).

(44) N. H. D. says: I am about to make a small windmill, the wheel of which will be 30 inches in diameter, having 8 equal arms, the broad part being 9 inches wide at the top, 6 inches at the bottom, 9 inches long, the wheel and its shaft being geared to a perpendicuiar rod, and small gear wheel being 1 inch, large one being 1½ inches. Give the size of water pump that can be used, and size of airpump. A. See SCIENTIFIC AMERICAN, vol. 32, No. 16.

(45) A. W. C. says: I have a 20 foot x 50 inch tubular boiler, iron chimney 42 feet high, size 28 inches. My draught is poor. I am about to put on a fan blast over my wheat burr; will it increase my draught sufficiently to attach a pipe to the fan and connect it to the chimney? If not, what length of chimney will I have to put in, in order to insure a good draught? A. The details are not sufficient to enable us to form a definite opinion. It seems probable, however, that the boiler is imperfectly set. 2. What shall I use in my boiler to remove scale? A. If you can freshen the water by the use of a heater with sediment collector, the scale will be gradually removed. The third question seems to be a query for judicial decision.

(46) L. P. M. says: 1. I have a Daniell's battery and am trying to do a little electrotyping, but not with very good success. I have set up my name and residence with type and taken a wax mould of it, and have covered the letters with good plumbago and connected it with a battery. The copper deposits thick on the wire and the smooth part of the mould, but does not take hold of the letters, or only a thin film around them. Can you tell me the reason? A. See that every point of the matrix is covered uniformly with an unbroken film of the plumbago, and then, after blowing out the excess of dust with a small hand bellows, lay the mould face upward, pour a little water over it, and see that the water enters freely every letter; careful manipulation with a small camel's hair brush will remove air bubbles. Then immerse in the bath and proceed with the plating. 2. In "Muspratt's Chemistry," issued by Mackenzie, p. 799, in speaking of Daniell's constant battery, says: "m and n are brass rods fixed longitudinally over the trough; to the former, m, are suspended the moulds, to the latter, n, sheets of copper exactly facing the moulds. The zinc of the battery is connected with the rod, n, and the copper of the battery with rod, m." The diagram shows the reverse of this. Which is correct? A. Join the cathode or rod to which the moulds are affixed to the zinc pole of the battery; a wire then joining the coppers of the battery with that of the bath properly completes the circuit. 3. On p. 788, in charging the battery, it says the copper cylinder is filled with sulphate of copper acidulated with ⅛ of bulk of sulphuric acid. Would not the latter have a tendency to eat the copper? A. It is not advisable to add sulphuric acid; a little sulphate of zinc is commonly used instead, or, what is better, after charging with copper sulphate, short circuit the battery for a few hours, at the expiration of which time it will be found to have attained its full power.

(47) T. M. says: I. I. says large reservoir, 20 feet deep, 200 feet fall, 2 pipes equal in size and length, one at bottom the other near top (does not say how near top), which will discharge most water 2 miles distant. Suppose we drop the 250 feet fall, insert the pipes one at bottom and the other at 6 inches below the surface enough to be sure and fill the upper pipe and a constant head. It is plain, without calculation, which will discharge with the greatest velocity, and of course the greatest quantity; now we will add the 200 feet fall by laying the pipes to the town. The extra fall cannot, it seems to me, decrease the velocity of water at bottom of reservoir; now does not the lower pipe have the advantage of an initial velocity, due to the head of 20 feet at reservoir; and discharge at the town a correspondingly greater quantity? A. In case of the pipe near the surface, it would be necessary to add to the 200 feet fall the difference of level between the two pipes.

(48) J. F. says: I am running or have charge of a stationary boiler of the locomotive type. The water I am feeding the boiler with is very hard, leaving a scale on the tubes and crown sheet from $\frac{1}{16}$ to ⅛ thick, and so hard that it will take a very sharp chisel and a smart blow with the hammer to pierce it. At one time I put a box of concentrated lye in the boiler to see if it would have effect on the scale. It did not even make the boiler prime, and on examination the scale was about the same as before. Since then I have been putting "Cataqua" in, pumping it in with the feed. It makes the water prime or foam, but not so as to deceive me. One week ago I examined the scale in the boiler. In places on the crown sheet I found broken pieces $\frac{1}{16}$ and ⅛ of an inch thick. Was it the strong action of the fire at times, or was it the sudden contracting of the iron after all the water was blown out, that caused the scale to break off in places? A. Probably the scale was broken off by sudden contraction. It is a bad plan to blow off a boiler as soon as the fire is hauled. Let the water remain in the boiler until it has become quite cool, and then run it out. By pursuing this course the scale will frequently be softened so that it can readily be removed.

(49) J. B. says: What is the best and cheapest method of making axle grease? A. One part of fine black lead, ground perfectly smooth, with four parts of lard.

(50) A. G. S. asks: Is there any way to color meerschaum pipes otherwise than by continued smoking? A. See SCIENTIFIC AMERICAN No. 12, vol. 36, p. 186 (40).

(51) W. M. asks: What will make a good black paint for painting boiler heads, smoke stacks, etc.? Is there a fireproof cement for laying brick in lining furnaces? A. See No. 3 present volume SCIENTIFIC AMERICAN, p. 43 (46), and No. 4, p. 59 (14).

(52) T. B. S. asks: Will you give me some information regarding the "Rose of Jericho?" A. This name is given to an oriental plant which is found in northern Africa, Syria, and Arabia. It is an annual and grows in sandy wastes. The stem is very short, with branches a few inches long spreading in all directions. After the plant has flowered, and when the pods begin to ripen on the approach of dry weather, the branches drop their leaves and begin to curl inwardly, and in time the whole resembles a ball of wickerwork at the top of a short stem. When the rain falls, or the plant is placed in moist situations, the curled and dried leaves unbend, and become as a green plant. In its native country it is surrounded by various superstitions. In Palestine it is called *rosa Mariæ* and *raf Maryans* or Mary's flower. It is sometimes called the Resurrection Plant.

(53) W. T. asks for information about making soap, and says: I undertook the manufacture of common washing soap for clothes. I succeeded in making a soap of good quality, but altogether too soft, and not capable of hardening although exposed to the air for a long time? A. If you were to obtain "A Practica Treatise on the Manufacture of Soaps," published by John Wiley & Son, New York city, or "A General Treatise on the Manufacture of Soap," by Professor Dussauce, published by H. C. Baird, Philadelphia, you would find all the information you require.

(54) T. C. asks for information about making black ink: A. The following recipe is said to make a very fine and durable ink: Aleppo galls (bruised) 12 lbs.; soft water, 6 gallons; boil in a copper vessel and add water to make up that lost by evaporation; strain, and again boil the galls with 4 gallons water for half an hour; strain and boil the third time with 2½ gallons water. Mix the liquors and while hot add 4½ lbs. coarsely powdered green copperas and 4 lbs. gum arabic. Agitate until dissolved, and strain for use. Product, 12 gallons fine and durable ink.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the result stated:

J. S.—It is galena—a sulphide of lead. Galena usually contains a little silver.—R. F. G.—(Minerals in red box). It is marcasite or white iron pyrites. See article on p. 7, vol. 36.—J. M. G.—It contains silicates of alumina, soda and alumina, and sulphate of lime. It may be used in the manufacture of pottery, etc., and on the farm.—C. B. K.—The substance is nearly pure metallic lead. It is possible that the small granules (some of which approach crystalline form) may be native lead—a substance almost unknown. It is, however, far more probable that they were at one time musket balls. The coating is plumbic carbonate and sulphate. You should send larger quantity if possible.

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

On an African Continental Railroad. By A. W.
On Sizes of Safety Valves. By R. H. T.
On a Simple Way to Make Ice. By ———.
On a Thread Snake. By A. B. A.
On the Divining Rod. By J. L. H.
On Carrying a Bar of Iron. By S. B. E.
On Speed of Rafts, etc. By C. G. C.
On Snakes Catching Fish. By W. S. B.

Also inquiries and answers from the following:

E. T. L.—J. M., Jr.—A. M. S.—C. H. W.—E. T. L.—C. P. W.—H. P.

HINTS TO CORRESPONDENTS.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Inquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail, if the writer's address is given.

Hundreds of inquiries analogous to the following are sent: "Who sells instruments for mining engineers? Who sells long staple cotton gins?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

OFFICIAL.

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

June 26, 1877,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list, including both the specifications and drawings, will be furnished from this office for one dollar. In ordering, please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

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DESIGNS PATENTED.

10,068.—CASKET HANDLE LUGS.—C. Barmore, Cincinnati, Ohio.
10,069.—CASSIMERES.—O. F. Chase, Thompson, Conn.
10,070.—TOBACCO BAGS.—W. J. Cussen, Richmond, Va.
10,071.—CARPETS.—E. Daniel, Paris, France.
10,072 and 10,973.—ORGAN CASE.—S. Hayward, Boston, Mass.
10,074.—COVERS FOR SMOKING PIPES.—J. Kirschbaum, Waterbury, Conn.
10,075.—CRADLES.—L. E. Minott, Sheboygan, Wis.
10,076.—GROUP OF STATUARY.—John Rogers, New York city.
10,077.—MILK JUGS.—T. C. Smith, Greenpoint, Brooklyn.
10,078.—FUNEREAL ORNAMENT.—W. M. Smith, West Conn.

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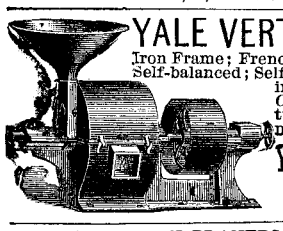

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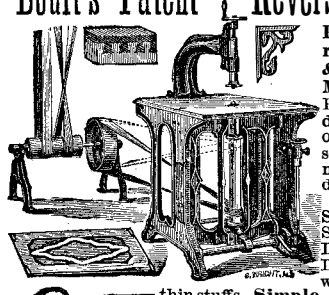

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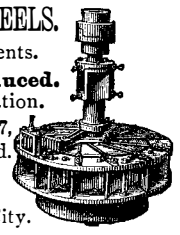

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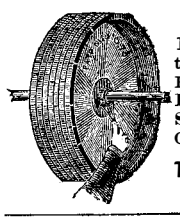

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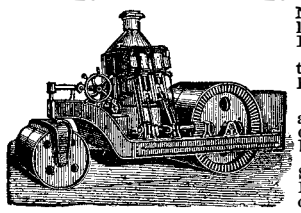

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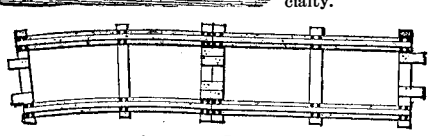

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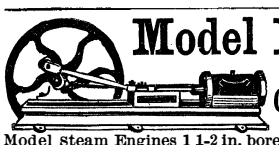

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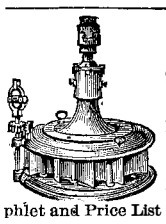

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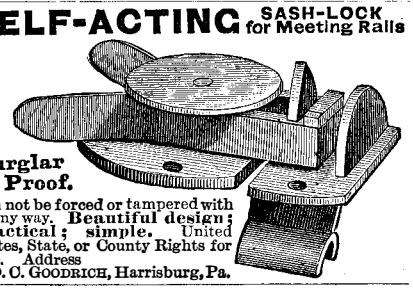

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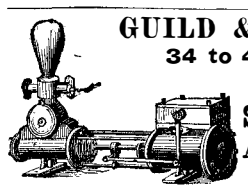

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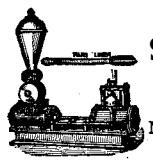

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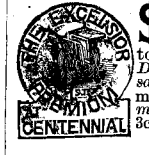

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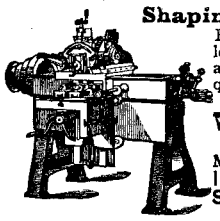

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